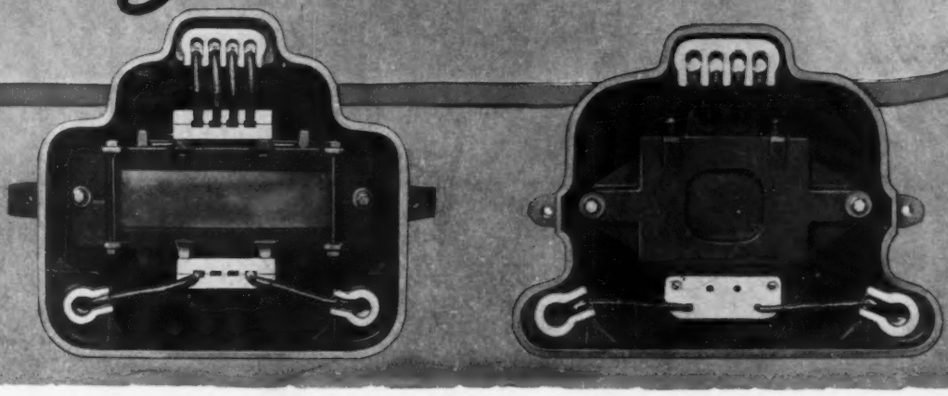
# Electrical World

McGraw-Hill Company, Inc. New York, January 28, 1922 Twenty-five Cents a Copy



## Drawing the line in Transformer Selection



## Note that the Bushings are protected

Where bushings project beyond the profile of the case—they are liable to become broken.

Note that this is obviated in Wagner Transformers because the case protects them against breakage in handling.

Also note that the core and coils are rigidly held in place so as to prevent them from being loosened in shipment.

All this is to safeguard you before the transformer is connected. But similarly effective measures protect you after the transformer is on the line.

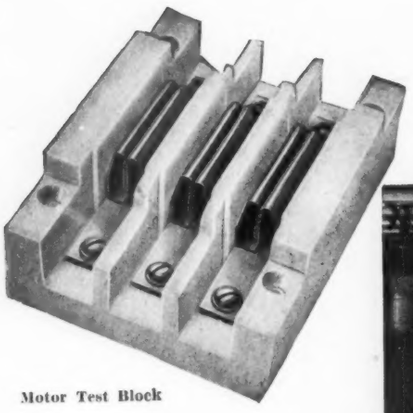
The efficiency and regulation due to Wagner design is a matter worthy of serious consideration.

Because iron loss goes on all the time that the transformer is connected to the line—and the copper loss only during the time that consumers are using energy, Wagner Transformers have been designed for low core loss and high all-day efficiency. The result is secured by a proper balance of core and copper losses.

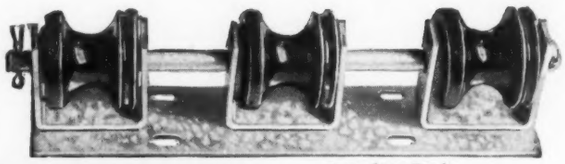
Have you in your reference library a copy of the Wagner Bulletin No. 128 which treats in detail this important subject?

## Wagner Electric Manufacturing Company,

Saint Louis, Missouri, U.S.A.

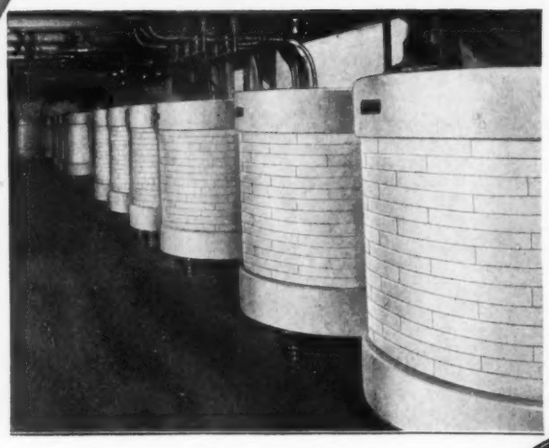


Motor Test Block



Reactance Coils

Secondary Rack



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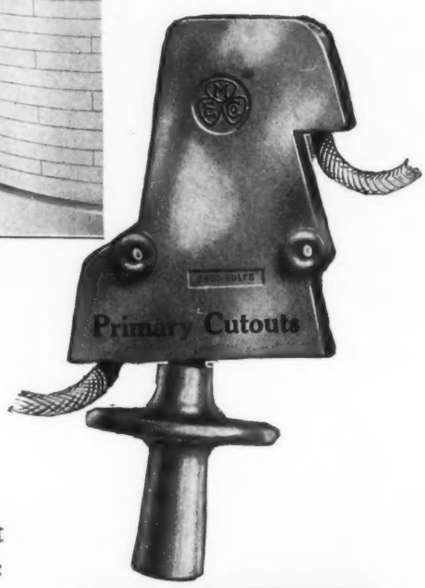


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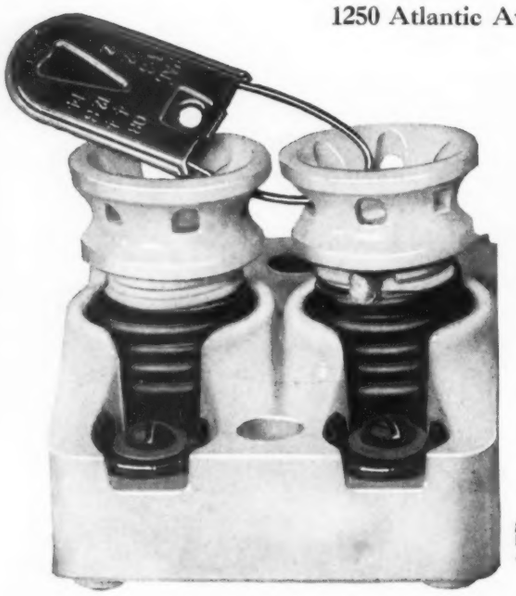
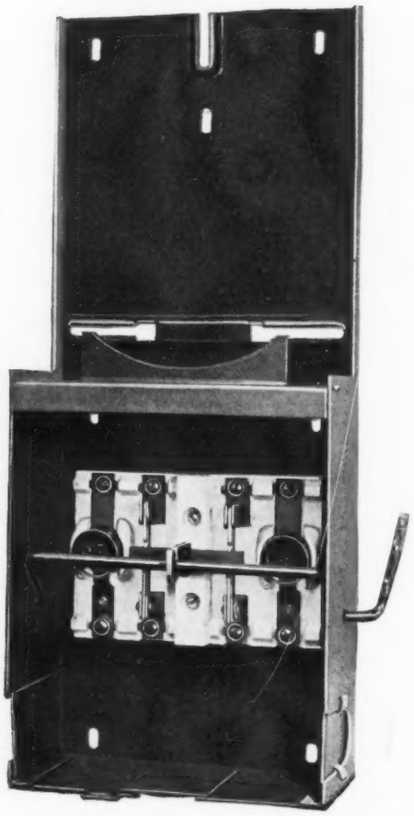


Sealable Fuse Plugs— All Amperages



Entrance Service Switch

# Electrical World

*The consolidation of Electrical World, Electrical Engineer and American Electrician*

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# *The Future of the Jobber*

WHEN people ask the oft-heard question, "Is the electrical jobber coming or going?" it shows one thing. It shows that they have not thought down inside of it, that they do not understand what a real jobber is supposed to do. They fail to recognize the difference between an imitation jobber and the man who actually performs this economic function in our scheme of distribution.

The jobber—the real jobber of electrical supplies—does these six necessary things for the manufacturer:

1. He catalogs his product—sometimes 50,000 articles—in one book to make the purchaser's selection easy.
2. He carries these diverse products in large local stock and gives the manufacturer a nearness to the market that he could not maintain unaided.
3. He reduces the expense of selling through the activities of his own salesmen.
4. He assumes responsibility for quality, vouching for the distant manufacturer to many local customers.
5. He assumes a credit responsibility, carrying a great many small scattered accounts.
6. He buys in large-quantity and standard packages and assists the manufacturer to a uniform production and lower costs.

THE jobber—the real jobber—does these six necessary things for the central-station, the industrial plant, the contractor and dealer:

1. He functions as a purchasing agent by selecting and gathering from reliable sources the full variety of the materials they require.
2. He enables these purchasers to satisfy all their needs from one convenient point without the delay and detail of buying from many cities.
3. His large and varied stock relieves his customers of carrying many stocks in their own warehouses.
4. His catalog provides a practical directory invaluable to purchasing.
5. His salesmen travel the local territory intensively and bring the market to all doors.
6. He renders emergency credit and operating assistance and advice through his staff of specialists.

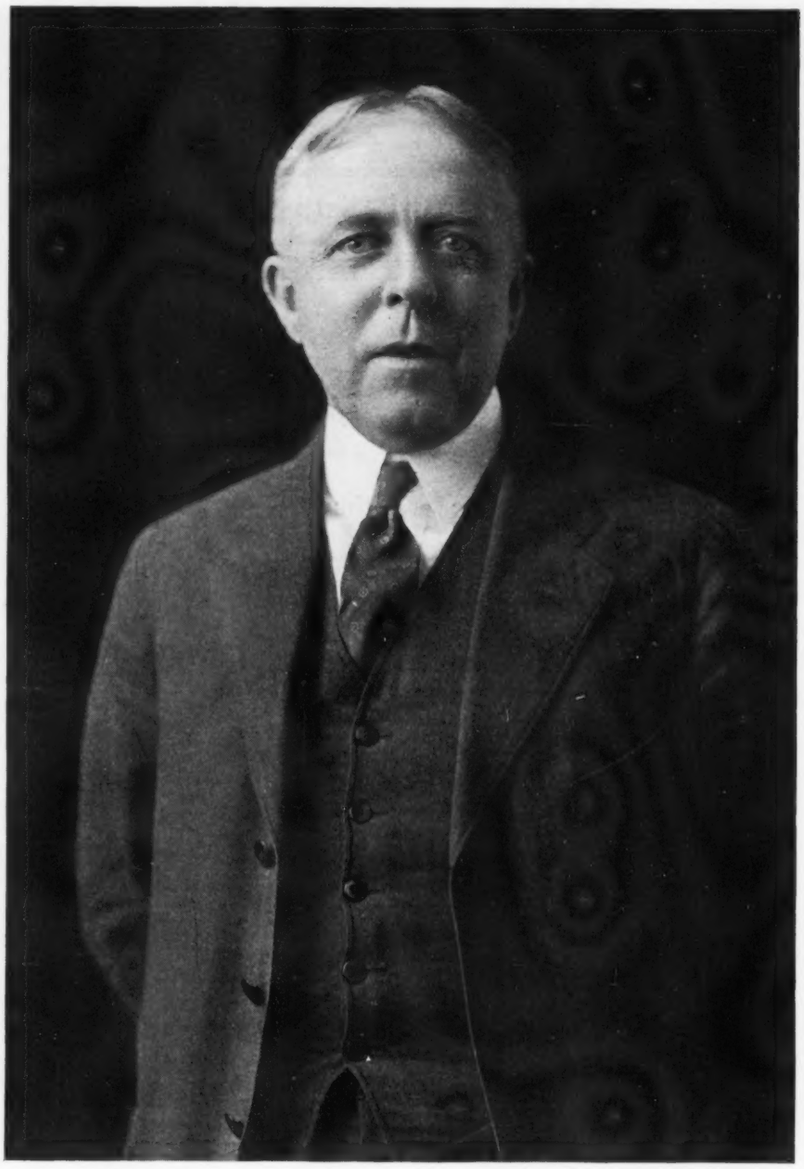
THIS is the true economic function of the jobber, and when he does these things he pays his way and is entitled to his profit. He makes it possible to distribute electrical materials more cheaply and to purchase them more easily and at no higher price. He deserves the recognition and support of every manufacturer and every man who buys in quantity. He will prosper and endure.

But the imitation jobber who does not render service with his warehouse and his catalog and assume responsibility for purchasing in bulk, for intensive selling and for carrying the credit burden—he is a parasite. He does not earn the jobber's profit. He will not endure.

The future of the electrical jobber is in two hands—the manufacturer's and his own. The jobber himself must carry his full load, do his job and render his full economic service. And the manufacturer must not destroy this needed service by paying jobber's profits to any one who does not function fully. For if he scatters jobber's profits to the men who merely gather orders for factory shipments, the jobber cannot live.

# Samuel Ferguson

*Utility executive, engineer and economist, whose knowledge of the industry and unusual vision of its future are nationally respected.*



LEADERSHIP in industry today as never before demands a combination of qualities in which imagination and the ability to handle concrete problems are completely in phase. While this is essentially true of the electrical industry in every branch of the art, the power to coordinate possibilities with present actualities is peculiarly useful in the administration of public utilities. A number of unusual men who are devoting their lives to this service are scattered here and there about the country. Their insight into the ever-changing problems of the industry and their foresight as to trends are matched by their ability to realize the viewpoint of others and so to guide the properties under their management along soundly chosen paths in the fields of technical progress and commercial policy.

On Feb. 13 it will be ten years since Samuel Ferguson entered the Hartford (Conn.) Electric Light Company as vice-president, becoming closely associated with the late Austin C. Dunham, whose presidency during the formative years of that famous utility will always be a significant part of electrical history. Mr. Ferguson came to Hartford after a dozen years of service in the research laboratories of the General Electric Company at Schenectady, where he was closely associated with Dr. Steinmetz and other leaders in the engineering and manufacturing fields. He was born at Exeter, N. H., in 1874 and was educated at Trinity College, Hartford, and the Columbia School of Mines.

Mr. Ferguson's interest includes virtually the entire range of problems surrounding modern electric light and power company administration. Taking up the burden of greater responsibilities upon the passing of Mr. Dunham, the full play of his exceptional analytical powers and grasp of technical and commercial problems has been brought to bear, with those of his associates, upon the progress of the company, which still maintains its remarkable reputation for initiative plus practicality.

This diversified activity contributes to breadth of outlook, and Mr. Ferguson's absorbing interest in the economics of business is paralleled by his insight into public relations, sales activities and engineering. His accessibility to his employees and to the public, his capacity to listen, sum up and weigh divergent views in making decisions and his sense of fairness to customers are characteristic. Courage to advance along broad lines of development in the face of adverse conditions is his, with a participating and enthusiastic comprehension of what interconnection and co-ordination can do for utilities and the public. His judgment is sought in other than electrical undertakings.

# Editorial Comment

Electrical World, January 28, 1922

Volume 79 Number 4

## Harbingers of Electrical Prosperity

TWO annual reports issued this week indicate a most encouraging condition in the electric light and power field, and from them the rest of the industry should imbibe much that is comforting and reassuring. In both New York and Detroit the electric public utilities show magnificent gains in both income and output. The electrical properties of the Consolidated Gas Company—that is, the New York Edison Company and the United Electric Light & Power Company—sold 1,186,000,000 kw.-hr. last year, an increase of 17.25 per cent over the previous year, and net revenues also increased. As indicative of the large amounts of money required by the industry even in periods of depression, it is of interest to note that the capital expenditures of the Consolidated Gas Company for its electrical properties last year were $33,624,000, and it is estimated that almost as much will be required this year.

In Detroit, despite the great slump in the sale of automobiles, Detroit's chief industry, the Detroit Edison Company, managed to increase its net earnings 37.6 per cent over last year, a truly remarkable showing. Alex Dow reports that the operating ratio has fallen to 66.9 per cent from 77.6 per cent, although the operating ratio for 1916, which was considered to be a normal year before the war, was 54.5 per cent. The actual unit costs have also been reduced. Naturally any decrease in the cost of coal will redound to the credit of all coal-burning central stations, but in addition to that the Detroit Edison Company has also been more efficient, in that during 1921 it was able to reduce the amount of coal burned per unit of electricity produced. Inasmuch as both New York and Detroit are great industrial centers, this increase in output would indicate increased industrial activity, which central-station companies would be the first to experience.

## When Information Given Means Money Gained

IN THE sale of machinery or other apparatus capable of being driven by an electric motor or a gasoline engine, the motor sale, and consequently a consumer of electricity, is now and then lost by apathy or delay in answering correspondence or oral requests concerning the availability and type of energy-consuming device to be supplied, the rules to be observed as to operating conditions and other information of a similar character. A large motor manufacturer writes: "It does seem as if the electric service companies are negligent in furnishing customers with the information they require in order to avail themselves of electric service. Of course, this reduces our sale of motors. We have a lot of dragged-out correspondence and unavoidable work every time we attempt to sell a motor, and we lose a good share of the orders owing to the difficulty of getting prompt information from the public service companies." From the character of the business done by the company in question, we judge that the condition complained of is not entirely local and therefore emphasize the necessity for promptness in such matters. There never should be a time when information is not freely, cheerfully and promptly given in the public utility field, and we know that any other tendency has only to be cited to be suppressed.

## Penalizing Industry for the Sake of Government

WE SUPPOSE that as long as the world lasts and human nature remains as it is taxes of any kind will never be popular. There will always be those who pay taxes grudgingly, others who complain of discrimination in their application, and yet others who know of no reason why they should pay taxes at all. But until we reach that blessed Elysium where no mention of the tax is heard we must continue to pay taxes because we believe in government and government costs money. There are individuals, however, who recognize the burden that taxes place on industry, and many communities seeking new industries offer them freedom from taxes for a period of years. This the city fathers do, not because they expect to shoulder the burden, but because they know that new industries bring more people, more houses and more business and thereby spread the tax burden so that each individual's part of it becomes less. Government, in order to get its money cheaply, makes the income from its securities tax-exempt. It is very apparent now that if the practice continues we shall soon reach a point, if we have not already reached it, where the government not only imposes an unreasonable burden on industry through the issuance of its tax-exempt securities, but actually throttles it. Dr. E. R. A. Seligman, professor of political economy at Columbia University, estimates that there are outstanding a total of thirty billions of bonds entirely or partly tax-exempt, from which the government receives no revenue, and suggests that the government refund these into taxable securities, from which it will receive additional revenue of about three hundred millions annually.

In the public utility field particularly have the evils of tax-exempt securities been most apparent. These corporations, although they are in private hands, render a public service which is in most cases superior to and more efficient than the service meted out by competing municipally or governmentally owned utilities, and yet the securities of the latter are tax-exempt while the securities of the former, despite the fact that the earnings of the corporation and the service it renders are subject to public regulation, are given no such advantage. It would be reasonable to make the securities of all public utility organizations tax-exempt, but that is hardly possible since a burden already great is not mitigated by adding to it. The wisest and safest course to pursue would be to render

the income from all securities, by whomsoever issued, subject to tax. This will eliminate all discrimination without detracting from the salability of government bonds, which always, by their very nature, will be the safest securities available. A movement of this kind has already been started, but the reasonableness and justice of it must be brought home to the average man if it is to be successful.

## Future of Powdered Fuel in Power Plants

THE future of powdered coal rests on the development of methods of burning and the attainment of economies that will overcome the cost of powdering and drying and also the fixed charges that will be incurred in installing the equipment for these purposes. The amount of this increased cost was indicated to some extent in J. B. Johnson's article published in the Dec. 3 issue of the ELECTRICAL WORLD. Just what the real difference in fuel costs at the boiler will eventually be is something that no engineer can closely predict at the present time, since there has not been made public sufficient experience with actual installations over a long enough period to develop the information. Although Mr. Johnson's figures indicate a total operating cost in Arizona of $1.30 plus the fixed charges on the storage and powdering plant, it is not fair to charge all of this expense against the powdered-fuel plant unless the investment in equipment and the cost of handling and storing coal for the stoker plant with which it may be compared are also included.

The problem of the powdered-fuel engineer is the development of cheaper methods of fuel preparation and an elimination of some of the difficulties experienced in handling certain grades of fuel, clinkers and slag. Great promise is given in the figures of actual operation so far available, but there is a long road yet to travel that will call for real work. One field that is yet hardly touched is in the use of low-grade fuels that have hitherto been considered unusable. Several ambitious attempts to solve the problem are under way at the present moment, and the lack of serious difficulties so far encountered is the most hopeful sign of the future.

## The Hoisting-Motor Problem Again Considered

THE proper motor to use for a given hoisting job is often a puzzle to the designing engineer. The principal considerations on which the selection of motors for such work are based are given elsewhere in this issue of the ELECTRICAL WORLD by Gordon Fox. The field of mine hoisting is not touched because this is a special field involving some factors by which the more common industrial uses are not affected. There are some users of hoisting equipment who prefer the steam-engine-driven type to any other because of its supposed better flexibility in speed control, notwithstanding the greater cost of operation and other disadvantages. The developments in speed control of the alternating-current motor, while they have been great, do not yet appear to have quite equaled those with the direct-current motor, and on this account the engineers having to do with industrial-plant design continue to favor direct-current drive in spite of the obvious disadvantage due to the almost universal use of alternating current in the distribution of central-station energy.

One of the most puzzling items in the taking over of power service from the isolated industrial plant to the central-station system is the provision to be made for the hoisting and other variable-speed motor service that has been largely if not entirely direct-current. The problem is akin to that in the steel-mill field, where low frequencies have held favor because of their obvious advantages in certain operations requiring low-speed motors. The great advantage of tying up steel-mill service with the big transmission systems, and the tendency to make low-frequency equipment non-standard and therefore more and more expensive, is bringing a development that will ultimately force these plants into line with the prevalent practice.

The direct-current motor problem is another of the same character, though it seems to be somewhat less complicated, because changes can be made more gradually as new equipment is developed and plant requirements change. Temporary maintenance of direct-current service for shop service has less complication than is involved in the use of two frequencies in the same plant. The economic reason behind the development of central-station service is forcing the solution of the problem, and this will become more apparent with the further development of the big transmission systems in industrial territory.

## Is More Power the Only Solution of Longer-Distance Radio Communication?

OF THE many directions in which active investigation is being prosecuted in the field of radio transmission, the one most in the public eye at present is that of the extension of the distance of transmission. Both in this country and abroad new installations of great magnitude, and aiming to surpass all others in distance reached, are under way. It is characteristic of all radio problems that little is known of the underlying physical laws involved, and especially is this true of the action of these laws as affected by conditions on and above the surface of the earth. It is but natural therefore that the most striking features of the new long-distance plants, both here and abroad, are their increased size as regards aërial and power plant. The message must be put over, at whatever cost of equipment and energy, until the ultimate goal, transmission to all parts of the earth, is reached.

In considering the enormous size of these modern plants and the amounts of energy put into the antennas, and noting that radio engineers, for further extension of distance, appear to have only the one resource of higher power and more energy, one is tempted to ask whether a more careful intensive study, possibly by international co-operation, of the fundamental processes involved in radio transmission would not yield some new avenue of knowledge or method whereby equal results might be reached in a more elegant and more rational manner. Questions of this character are suggested by a description in the November number of the *Radio Review* of some remarkable results obtained by Dutch East Indian engineers in transmission from Java to Holland, a distance of 12,000 km. This was accomplished first with a Poulsen arc of only 100 kw. capacity, and the success was attributed to the discovery claimed by one of the engineers that at night and using short waves it is relatively easy to transmit between points distant by multiples of 3,000 km. The equipment was subsequently increased to 320 kw., with which certain communication with Holland is said to be possible and

which provides basis for a claim to having surpassed all other stations in the matter of distance reached. Other interesting features of the station in Java are the aërial, which is suspended on steel cables from opposite sides of a natural gorge, 900 km. high, and a 3,600-kw. Poulsen arc, with equipment, now nearing completion. The arc is preferred by the engineers of this plant to the high-frequency generator, also installed, as transmitting means, because of the greater flexibility of the former as regards wave length and the difficulties of speed control with the latter. It is noted that the tenfold increase in the capacity of the new arc is solely for the purpose of increasing the amount of received energy in Holland to make the system free from disturbance by the large European stations, and so reliable for commercial service.

Additional point is given to this question by the results of the recent transatlantic tests open to all amateur operators and stations. The results of these tests were astonishing as regards the number of amateur stations which reached the other side of the Atlantic. As many of these stations were of low capacity and equipped with the simplest types of apparatus, it is obvious that high power is not always necessary for long distance. Perhaps after the world is encircled through the use of more and more power and the beckon of the first achievement is no longer present, a wider study of the nature of the processes underlying the instrument may be conducted.

## Transformer-Oil Test That Is Susceptible of Development

OIL for insulating purposes is so seriously affected by even the slightest traces of water that high-voltage systems must of necessity be provided with equipment of considerable elaboration for the protection, testing and purification of the insulating oils. Thus power transformers are provided with so-called conservators for avoidance of moisture arising from internal condensation, permanent provision is often made for the periodical drawing off of the oil for drying, and some form of testing equipment for studying the moisture content is often provided.

Of the methods in use for measuring the moisture content of insulating oils, aside from various rough condensation tests, the best known are those using filtration, as, for example, through blotting paper, and for which special apparatus is available, and those in which the water is decomposed chemically and the gases evolved are collected. In another column we print an article by J. E. Shrader describing an interesting new method which the author asserts is free from serious errors pertaining to other methods. Briefly the method consists in spraying a known amount of the oil into a vacuum at high temperature, condensing the water and gas vapors in a liquid air trap, re-expanding them, measuring the volume and pressure, separating the water vapor with phosphorous pentoxide, and measuring the volume and pressure of the residual oil vapors. Two simple applications of Boyle's law enable the pressure volume and so the weight of the water vapor to be computed. While the article does not report in detail tests as to the accuracy of the method, and while it involves somewhat more elaborate measuring equipment and skill than are readily available for a routine operation, it is nevertheless simple in principle and appears susceptible of important development and use.

## Co-operation of Architects and Engineers Needed for Proper Illumination

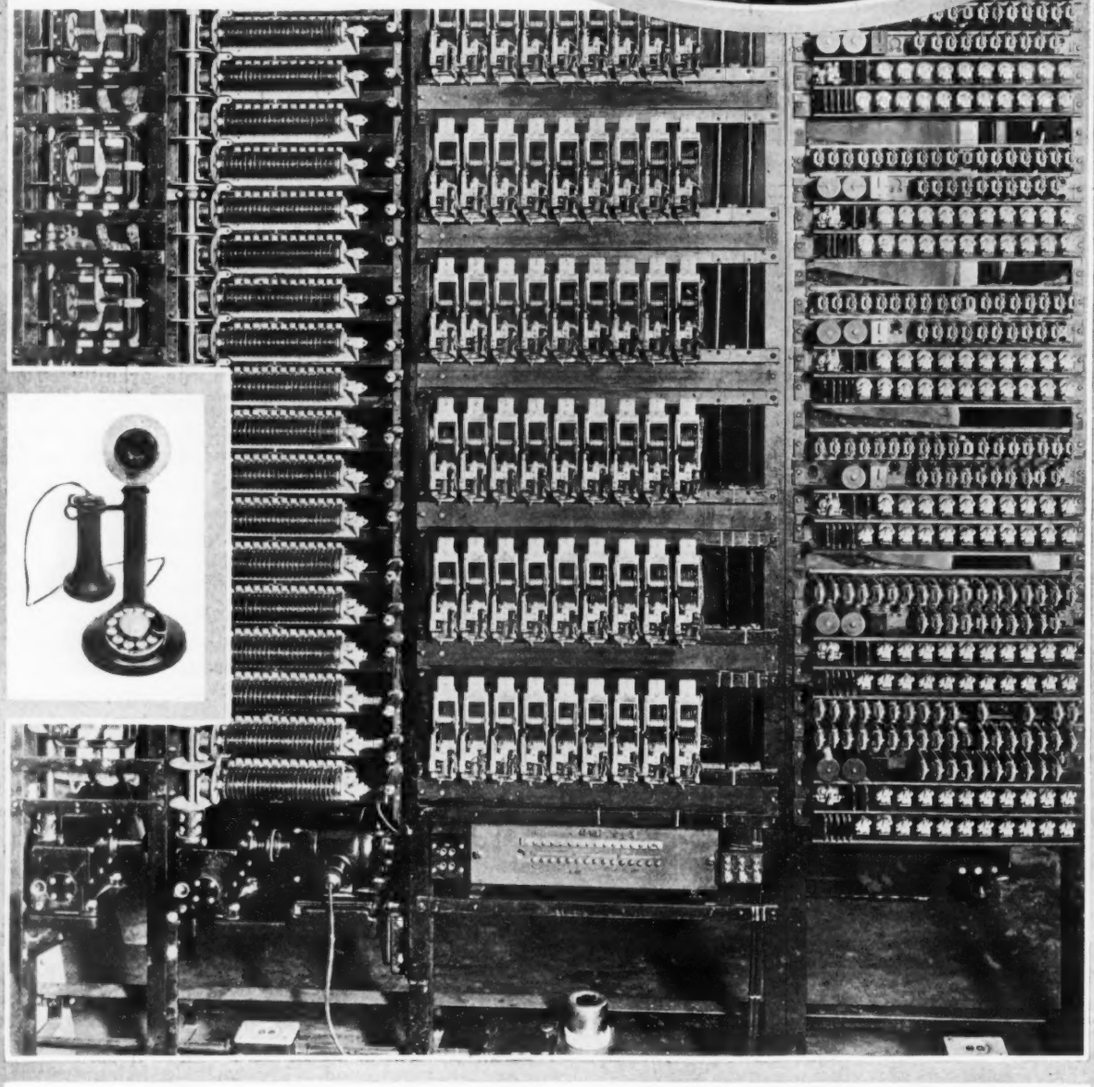
MANY building interiors and exteriors which might have been architecturally beautiful have been spoiled either because an architect who was not an illuminating engineer tried to design the lighting or because the requirements of the illuminating engineer were not taken into consideration in laying out the architectural scheme. Such unfortunate situations could be prevented if architects and illuminating engineers would come to a mutual understanding that they have a common purpose and that neither one can produce effective results without full co-operation from the beginning. Attempts have been made by the Illuminating Engineering Society through its reciprocal relations committee to bring about such co-operation, but in general these efforts have been futile. Sometimes where individuals have attempted the solution the architect has believed that the engineer was trying to tell him how he should design the structure; at other times the engineer has felt that the architect was specifying things beyond his sphere of knowledge. No doubt both sides have often been at fault in the past, but that should not prevent their putting petty jealousies aside and attacking the problem anew. Both are experts in their respective fields, and each should respect the other's knowledge. Co-operation can be expected only where the engineer looks to the architect for advice regarding the application of illumination fundamentals in an artistic way, and the architect must tell the engineer what effects he wishes to accomplish and then, if necessary, must so modify his design that illuminating equipment may be selected and laid out with the least possible hindrance.

It is hoped that any further attempts of the Illuminating Engineering Society to bring about co-operation between architects and engineers will meet with more success. However, the results to be desired will be attained only if engineers prove to architects that the efforts are being made for mutual benefit.

## Is Short-Circuiting and Grounding Practice Satisfactory?

THE common assumption that simply throwing a chain over the conductors of a circuit on which men are working to short-circuit and ground it for protective purposes is sufficient is rather seriously upset by the data presented elsewhere in this issue by Alfred Herz, giving the results of some tests made on the system of the Public Service Company of Northern Illinois. Short-circuiting and grounding has become an accepted standard protective measure, but in practice, on line work in particular, it has been commonly applied in the manner just mentioned. The tests in Illinois reveal conditions of resistance under varying degrees of tension that are rather startling and suggest the need of intensive study of the subject on the part of the safety and technical committees of the National Electric Light Association that are interested in operating and construction work. Resistance of an ohm or two up to infinity for chains depending only on their weight for good contact, when taken into consideration with unavoidable ground resistance, indicates rather disturbing possibilities in injuries to workmen on the high-tension lines on which they are used as a protective measure. The effect of electric current on the various types of chain tested points to the need of further investigation.

# Transition from Manual to Machine Switching in Large Cities



TO HANDLE the congested and very rapid growth of traffic in the larger cities the Bell Telephone System has developed and is installing machine switching equipment which will take the place of manual switching now used. The transition will be gradual, one office at a time being changed over. During the transition special manual equipment like that shown in the oval is required to handle calls between manual and machine switching offices. The machine switching apparatus is power-driven and is not actuated directly by the electrical pulses sent out from the subscriber's dial. These pulses are used merely to set up the proper combination in the sender (shown above), which in turn controls the motion of the various power-driven selectors (not shown but which are mounted in a similar manner).

# Factors Affecting Installation of Electric Motors for Hoisting

## Methods of Determining Size of Motors Required—Various Types of Skip Hoists and Their Use—Advantages and Disadvantages of Alternating-Current and Direct-Current Drives for Skip Hoists

By GORDON FOX
*Engineer with Freyn, Brassert & Company*

ELECTRIC motor drive offers many advantages for hoist service and is applied in a variety of ways. Two common types of hoisting practice, namely, general-service and skip hoists, will be considered in this discussion.

For general-service hoists motors fall principally within the range from 5 hp. to 50 hp. Drum controllers are commonly used, except for constant-running squirrel-cage motors, where a starting compensator is employed. The duty required of a general-service hoist is usually of a rather indefinite nature. The torque and power demanded for hoisting the capacity load is the determining factor. The motor size may be obtained by the simple formula: Hp. $= WV/53{,}000e$, where $W$ = capacity, unbalanced load, pounds, $V$ = hoisting speed with rated load, feet per minute, and $e$ = efficiency of machine, usually 0.70 to 0.80.

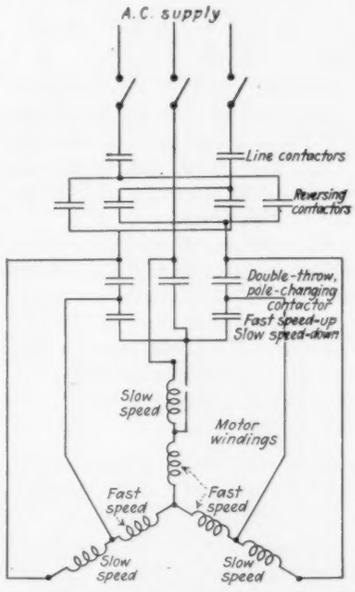
The prevailing load is ordinarily less than full load, and a variable-speed motor having a thirty-minute to sixty-minute rating equal to the horsepower as determined will meet all ordinary requirements. The sixty-minute rating should be used when the service is severe or constant.

The construction hoist is the most common and simplest type. It comprises a cylindrical drum upon which is wound a cable passing over guide sheaves and a head sheave to the load. The load is entirely unbalanced, so that its full weight must be overcome by torque exerted at the drum. General-service hoists of this character range in capacity up to 3 tons or 4 tons. The hoisting speeds used range from 75 ft. to 200 ft. per minute, according to the lift and the nature of the service.

### Direct-Current Versus Alternating-Current Motors

Both direct-current and alternating-current motors may be employed for general-service hoists. As alternating current is most often available, however, the direct-current motor must prove sufficient superiority to justify its use. In starting torque and pull-out torque the direct-current series motor fulfills the requirements excellently. This type of motor may be geared directly to the winding drum and dynamic braking may be employed for lowering. An electrically operated holding brake is applied at the motor. Many hoists of this type are equipped with a clutch between the motor and the drum. When lowering, the clutch is disengaged and a hand or foot band brake acts upon the drum shaft. A brake on the motor is not entirely necessary with the clutch type of hoist but the motor should have sufficient shunt-field winding to prevent serious overspeeding in case the clutch is disengaged with full power on the motor.

Squirrel-cage induction motors are used with a clutch for some small hoists. The motor is permitted to operate continuously. Lowering is controlled manually by a band brake on the drum. A high-resistance-rotor squirrel-cage induction motor can be used without a clutch for small hoists which do not have frequent service such as for car pullers, ice hoists, etc. The motor may be started by being thrown directly on the line, when it will draw about 350 per cent full-load current and exert 250 per cent full-load torque. This drive is popular in sizes up to 20 hp. For the larger alternating-current hoists wound-rotor motors are provided. These may start and stop with each operation to give better control. Lowering is generally accomplished by manual braking, the motor being disengaged through a clutch. If the load that is to be lowered is sufficiently heavy to drive the motor, regenerative braking may be employed or the motor may be plugged with high rotor resistance. Motors for this class of service are specially designed with high magnetization to produce high starting and pull-out torque. This, however, causes low power factor and rapid heating. Such motors are suited to intermittent duty only and will overheat if operated continuously, even without load.




MAIN CONNECTIONS FOR MULTISPEED INDUCTION-MOTOR DRIVE FOR SKIP HOISTS

### The Skip Hoist

The skip hoist is widely used for handling ashes and for hoisting ore, stone and coke for blast-furnace charging. Sometimes skip hoists operate as unbalanced hoists and as such are very similar to the general-service hoists described. More frequently two skips are balanced against each other or a single skip is counterbalanced by a weight. Skip hoists for handling ashes range in capacity from 500 lb. to 5,000 lb. (226 kg. to 2,260 kg.). They may be either vertical or

inclined slightly. The hoisting speed ranges from 50 ft. to 200 ft. (15 m. to 60 m.) per minute, depending upon capacity and height of lift, but it should be no greater than necessary. If the counterweight is attached to the drum, the weight of the skip may be fully counterbalanced and additional weight may be supplied to counterbalance half of the normal load hoisted. This arrangement minimizes the size of motor required. The equipment must be able, however, to lower a loaded skip or to hoist an empty skip if required.

The load of a balanced skip hoist may be determined with sufficient accuracy by the formula: Hp. $= PV/33{,}000e$, where $P$ = net rope pull or force at winding drum; $V$ = rope speed (feet per minute), and $e$ = efficiency. Efficiency may be taken as 0.75 for a gearless hoist and 0.65 for a geared hoist. The rope pull $P$ depends on weight of skips and load and inclination of runway. The weight of the cable may be neglected. For an inclined skip the rope pull $P$ may be determined as follows:

$$P = L \cos \theta + \frac{(L + 2C) \sin \theta \times 25}{2{,}000},$$

where $L$ = weight of load (pounds), $C$ = weight of skip (pounds) and $\theta$ = angle of incline from vertical.

The first element in the equation is the net rope pull due to gravity. The second element represents the rolling friction on the basis of 25 lb. drawbar pull per ton of load perpendicular to the track.

When a skip capsizes much of its weight is relieved from the rope. In starting it is then virtually necessary to lift the loaded bucket and skip without counterbalance. The motor must have sufficient torque for this. The rope pull for this condition is given below. This may be translated into torque at the motor as follows:

$$P = (L + C) \cos \theta \frac{(L + C) \sin \theta \times 25}{2{,}000}.$$

Direct-current motors are used most extensively in skip-hoist service. With the unbalanced or partially counterweighted skip a series motor may be used. For a balanced or counterweighted skip a shunt motor is necessary, although a compound-wound motor arranged so that the series field is short-circuited during the running period may be used. If the load overhauls a series or compound-wound motor, it will overspeed, whereas a shunt machine will exert torque either as a motor or as a generator with very little change in speed.

Small ash and coal skip hoists are usually arranged for automatic operation by unskilled labor. A "start" button causes the magnetic controller to start and accelerate the motor. When the dumping position is approached limit switches cause the motor to slow down and stop. Slow-down is accomplished by introducing the starting resistance in series with the motor and shunting the armature with one step of resistance. A time relay is provided to introduce a dumping interval, after which the skip is lowered, slowed down and stopped at the lower limit of travel. All operations except starting are performed by the limit switches. It is necessary that one or more brakes be provided on the motor shaft to hold the load at any point.

Where alternating current only is available, a reliable and comparatively high-speed installation can be made by using an induction motor which may be operated at half or full speed. The motor has single windings in primary and secondary. The six primary leads are taken to a pole-changing switch and the six secondary leads to a star-connected resistance. Such a motor is admirably suited for small skip hoists having a full speed of about 250 ft. (75 m.) per minute, giving a landing speed of 125 ft. (37.5 m.) per minute.

The prime requirements of a blast-furnace skip hoist are reliability and continuous operation. For this reason the motor and equipment must have a high safety factor, the layout should be simple, and careful provision should be made for rapid repairs and quick renewals. Blast-furnace skip hoists are mostly balanced hoists equipped with one or two drums and two skips which counterbalance each other. They operate on an incline of 20 deg. to 40 deg. from the vertical. The travel distance ranges from 120 ft. to 200 ft. (36 m. to 60 m.). The skips weigh 5 tons to 10 tons, and the loads run from 1½ tons of coke to 11 tons of ore. The hoisting speed is usually about 300 ft. (90 m.) per minute, although speeds up to 500 ft. (150 m.) are used.

Direct-current motors are used in nearly all cases for blast-furnace skips with either single-motor or two-motor drive. Recently a few hoists have been equipped with special two-speed alternating-current motors. Some foreign hoists are equipped with variable-voltage equipment. The single direct-current motor hoist is the prevailing type. The motor is usually compound-wound, having a no-load speed about 125 per cent of full-load, full-field speed. The size ranges from 100 hp to 300 hp. as required. The voltage is commonly 250. The motors may be direct-connected to the winding drums, but more commonly the motor drives through two gear reductions and a flexible coupling. The motor speed is usually about 250 r.p.m. to 450 r.p.m. A series-wound brake is applied to the motor pinion shaft and a shunt-wound brake is applied to the intermediate shaft. This arrangement makes possible a change of armatures without disturbing the brake or pinion. Either brake should be capable of holding the maximum load.

### METHODS OF CONTROL

Magnetic control with current-limit acceleration is extensively used, but time-element acceleration is gaining popularity because with this system the accelerating time is independent of loading and not affected by an overhauling condition. A moderate rate of acceleration, about 1 ft. to 1½ ft. (0.3 m. to 0.5 m.) per second per second should be used. During acceleration the series field is effective. The last accelerating point short circuits the series field converting the motor to a shunt machine during the running interval. The hoisting speed is thus made largely independent of load, even in case of overhauling. When the skip approaches the knee in the track a limit switch functions, causing the series field to be introduced, putting the starting resistance in circuit and shunting the armature with resistance. This causes the skip to slow down. As the skip travels over the knee the armature-shunting resistance is reduced in one or more steps so that the skip speed is reduced to about 50 ft. (15 m.) per minute. When the skip dumps, the limit switch causes the motor to stop and the brakes to set. Two or three steps of slow-down resistance are desirable in order to limit the retarding current in slowing from full speed and in order to compensate for the load variation as the skip capsizes and decreases its rope pull. At the instant of dumping the load becomes overhauling. The limit switches may be driven by the winding drum or may be installed along the runway and actuated by the skip. The former arrangement is most used, its principal disadvantage being the necessity to adjust for cable variations.

As the load weights vary widely, the slow-down speeds tend to vary to some extent. Therefore controls have been developed to adjust the slow-down resistance in accordance with the motor speed. These are somewhat complex, and the simple method of reducing the armature-shunting resistance at two or three fixed points of travel is entirely satisfactory and to be preferred. Slack-cable switches are provided to stop the motor in case a skip fouls. A centrifugal governor stops the motor if the slow-down fails to function. An over-speed trip protects against any condition of power failure with an overhauling load which may cause the motor to generate power and hold open the brakes.

For a direct-current gearless skip hoist the motor must necessarily be a slow-speed machine, full speed being about 40 r.p.m. Therefore this type of equipment is relatively expensive, repairs involve large parts and changes are more difficult to make. An armature change can be made quickly in the case of the geared drive where the motor is coupled to a separate pinion and brake shaft and where the frame and brush rigging is horizontally split and arranged for rapid dismantling. On the other hand, the smooth, slow operation reduces the likelihood of motor failure to some extent. The equipment is very simple, has fewer parts and has also a lower kinetic energy. The control is similar to that used for the geared-type single-motor direct-current hoist.

### Double-Motor Equipments

The two-motor geared hoist offers the advantage of emergency operation with a single motor as each motor is rated at about 60 to 75 per cent of the total load. With two-motor drive series-parallel control may be employed, giving more accurate low-speed operation and decreasing resistance losses. The motors are compound-wound, with a light series field. The series fields are not cut out during full-speed operation as a drooping motor characteristic is necessary in order that the two motors may divide their loads properly. Difficulty is sometimes experienced in obtaining proper load division. Moreover, there is a possibility of considerable damage in case one motor develops a fault and bucks the other motor while running. Magnetic control is employed arranged for series-parallel acceleration and slow-down, and armature shunts are connected around each motor during slow-down. Drum control is employed for single-motor operation, circuits being quickly transferred from magnetic to drum control through use of a transfer switch. Two-motor drive offers a measure of advantage in that each motor is smaller and auxiliary drum control may be employed, whereas with single-motor hoists above 150 hp. rating the currents involved are rather heavy for drum control, and auxiliary control, if used, must be of the magnetic type. A two-motor equipment for a blast-furnace skip is somewhat more expensive than the single-motor equipment. The lower cost of spare parts and auxiliary control may compensate largely for the difference in first cost.

The single-motor hoist could be made to have higher efficiency at reduced speed and to give more accurate and uniform creeping speeds with control similar to elevator practice where adjustable-speed motors are commonly employed to give high running speeds with accurate creeping speeds, but this type of drive is a little higher in first cost, and tradition favors the single-speed motor or the two-motor design.

There has been some demand for an alternating-current skip-hoist drive. A few such equipments have been installed similar in general arrangement to the single-motor, geared direct-current hoist. The motor is of the induction type with wound rotor. It has two windings on the stator and two on the rotor, arranged for different numbers of poles to give two distinct running speeds. These speeds have a ratio of about six to one, being respectively 300 ft. (750 m.) and 50 ft. (15 m.) per minute. A magnetic control is provided for reversing and cutting over the primary windings and for adjusting the secondary resistance. The motor may start on either high-speed or low-speed winding, and acceleration is obtained by cutting out rotor resistance. Travel is at the higher speed, and slow-down is obtained by transfer to low-speed winding, causing a negative torque momentarily. Control is by limit switch and protective features are similar to those of a direct-current hoist.

### Advantages and Disadvantages of Alternating-Current and Direct-Current Drives

The advantages of an alternating-current skip hoist are as follows:

1. Alternating power used without conversion losses.
2. Low-speed operation can be maintained at a definite value regardless of load.
3. Change from full speed to low speed can be obtained with smooth retardation.
4. The efficiency at low speed is higher than that of a direct-current hoist, which absorbs considerable power in resistors.

The first-named advantage may be great, but, on the other hand, such equipment as ore bridges, unloaders and car dumpers is best adapted for direct-current drive. Where such equipment is used the skip hoist can obtain its direct current from the common source. The low speed of a direct-current motor can be controlled within the required degree of accuracy, although not as perfectly as the alternating-current motor. An entirely satisfactory change from full speed to low speed can be obtained with a direct-current motor provided proper control is installed. The efficiency of the direct-current skip-hoist motor at low speed is poor, but the alternating-current motor also has poor efficiency and poor power factor at low speed.

The disadvantages of the alternating-current motor for blast-furnace skip-hoist drive are as follows:

1. The motor is more difficult to repair. Defective coils cannot be cut out and isolated readily. The fact that the stator frame cannot be split horizontally and readily disassembled renders repairs on either stator or rotor relatively difficult and lengthy delays more probable.
2. The motor has a small air gap. This is a disadvantage as regards wear and also makes difficult quick assembly in case of repair.
3. The alternating-current brake is not the equal of the direct-current brake. A series brake is not feasible.
4. An alternating-current motor is heavier and more expensive than an equivalent direct-current motor.
5. Alternating-current control is heavier, more clumsy and more expensive than direct-current control.
6. The alternating-current motor takes a high starting current at low power factor.
7. The kinetic energy of the alternating-current motor is much higher.
8. The running speed is fixed. A direct-current hoist may be speeded up when desired.
9. The alternating-current skip-hoist motor is better adapted for 25-cycle than for 60-cycle circuit, to obtain the very low speeds required.
10. The voltage of the alternating-current motor should not exceed 440, for reliability, for safety and because of control considerations. Transformer conversion will therefore be necessary in most cases.

# Determination of Water in Transformer Oil

## New Method Which Does Not Involve the Usual Errors Encountered—Vapor Pressure Can Be Determined by Method

BY J. E. SHRADER
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ONE of the usual methods of determining the amount of water in oil is to decompose the water chemically, collect and measure the volume of evolved gases, and then calculate the weight of water in a given sample. There are several objections to this method. In the first place the evolved gases are soluble in the oil so that the total quantities of gases are not readily measured. The oil contains quite large quantities of absorbed gases which are apt to be carried off with the liberated gases, thus giving greater values than should be obtained. Then there is always the uncertainty of the complete decomposition of the water since this takes place only when the water and the decomposing agent are brought intimately into contact. Other methods which depend upon the release of moisture under vacuum and operations which involve weighing quite small quantities are rather uncertain because of the difficulties of eliminating errors during the process of weighing. This is especially true where the amount of moisture to be determined is quite small.

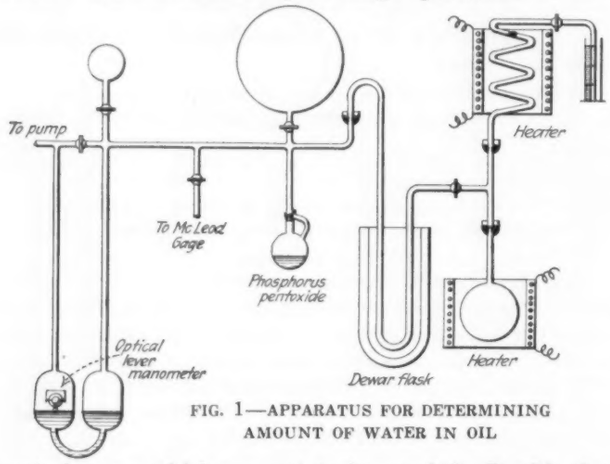



FIG. 1—APPARATUS FOR DETERMINING AMOUNT OF WATER IN OIL

A new method developed in the research laboratory of the Westinghouse Electric & Manufacturing Company, here described, avoids all the above-mentioned errors and is free of all others except those involved in observation and the error due to the assumption that vapor pressures which are well below the saturation point obey Boyle's law. This method consists in spraying the oil into a vacuum system and into a heated tube where under the influence of heat and vacuum the moisture is completely vaporized and separated from the sample. By condensing and isolating this vapor in a part of the vacuum system where it is allowed to re-expand in a known volume its pressure, together with that of the oil, is determined. By determining these pressures and by using Boyle's law the amount of water can then be determined.

The method employed and the apparatus used may be understood by referring to Fig. 1 and the following:

The whole system is thoroughly evacuated by a mercury diffusion pump. Liquid air or carbon dioxide snow is then placed in the Dewar flask and the sample of oil is introduced slowly from the graduated cylinder at the right by regulating the stopcock above. As the oil enters the spiral tube (raised to any desired temperature by the surrounding heater), the moisture and gases are liberated. The gases are continuously removed by the pump while the moisture is condensed by the liquid air or carbon dioxide in the trap. The treated oil is caught in the lower right-hand bulb, which is heated to the temperature of the spiral tube to prevent possible reabsorption of moisture.

After a sufficient amount of oil has been introduced the oil entrance stopcock is closed. After pumping for a short time to remove all gases from the system the condensed moisture is isolated by operating the stopcocks. With the phosphorous-pentoxide bulb cut off the liquid air or carbon dioxide is removed from the trap and the moisture and condensed oil vapor are allowed to expand. The pressure in this part of the system is determined by the optical lever manometer,* which measures vapor pressures of the order of 0.02 mm. Hg. After this pressure is determined the phosphorous-pentoxide bulb is opened and the moisture in the system is absorbed. The oil vapor is recondensed into the trap and the phosphorous-pentoxide bulb again cut off. The oil vapor is then allowed to re-expand and its partial pressure is determined. The difference between this partial pressure and the total pressure gives the pressure due to the water vapor alone. From the known volume and pressure of the water vapor its weight may be computed and expressed in percentage of the weight of the oil. When liquid air is used on the trap the carbon dioxide contained in the sample is also measured, but this has been found to be only about 2 per cent of the total moisture content. This carbon dioxide will be removed with the other dissolved gases if carbon-dioxide snow is used on the trap.

The auxiliary bulbs, having known volumes, are used when the moisture to be determined is of considerable amount and also to determine the volume of the rest of the system.

To determine how the temperature of the oil in a good vacuum affected the amount of water given off, several tests of "Lectroseal" oil were made at temperatures ranging from room temperature to 94 deg. C.

The results showed very slight variations of the amount of water released at different temperatures. It was noticed that the pressure of the oil vapor increases with the temperature, but only in the case of the highest temperature 94 deg. C., was there sufficient oil distilled over to produce saturation. The pressure in this case was 1.78 mm., which can be taken as the vapor pressure of the lighter constituents of this oil. While the results were true for "Lectroseal" oil, it is not true for all oils that water is readily given off at

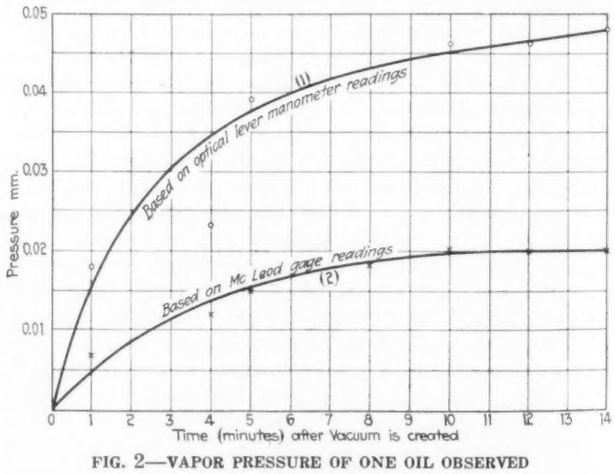



FIG. 2—VAPOR PRESSURE OF ONE OIL OBSERVED BY TWO METHODS

*This manometer was described by Shrader at the Pittsburgh meeting of the American Physical Society, December, 1917, and by Shrader and Ryder, *Physical Review*, May, 1919.

the lower temperatures. For high-flash oil which has a higher viscosity a temperature of 120 deg to 130 deg. is necessary to release all the water vapor.

The vapor pressure of the oil after undergoing the foregoing treatment can also be determined by the apparatus here described. In determining vapor pressure the entire system is pumped thoroughly and afterward the increase of pressure with time in the closed system is noted. The pressure increases quite rapidly at the start and then more slowly until an equilibrium pressure is reached which is the vapor pressure of the oil. To show how this vapor pressure reaches equilibrium the curves in Fig. 2 are plotted from observations of pressure with time. The McLeod gage with which one of the curves was determined, of course, does not read true vapor pressures, but the curve is given to show that corresponding equilibrium was obtained. From the results obtained with "Lectroseal"

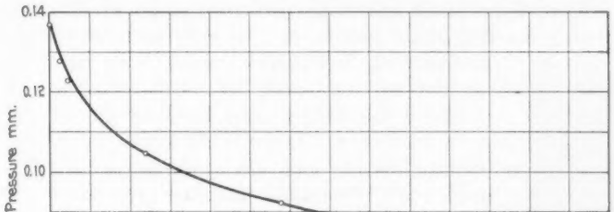



FIG. 3—ABSORPTION OF WATER BY PHOSPHOROUS PENTOXIDE

oil it was observed that there is a slight lowering of the vapor pressure after heating to the higher temperature. This can be explained by the fact that more of the low boiling constituents have been removed.

To measure the amount of dissolved gases in equilibrium under normal conditions this same experimental arrangement may be used. For this purpose, instead of continuing to pump while letting in the sample, the pump is shut off. The released air expands into a known volume, producing a given pressure, and its volume at 760 mm. can be calculated. The results obtained with "Lectroseal" oil showed that all absorbed gases are removed in vacuo even at room temperatures. Under the given conditions at 25 deg. C. the amount of absorbed gases in "Lectroseal" oil is 11 per cent by volume. In determining the amount of gases absorbed in oils considerable care has to be taken to avoid mechanical mixing of the air with the oil. In the case of the results here recorded the sample was siphoned carefully without splashing into a graduated cylinder holding sufficient oil for all the tests. This was then allowed to stand exposed to the air over night before testing. Previous samples taken somewhat carelessly differed from each other as much as 100 per cent owing to mechanically entrapped air.

Some question as to the absorbability of water and oil by phosphorous pentoxide might be raised. It was found by trial that moisture alone introduced into the vacuum system was removed in two or three minutes on exposure to the phosphorous pentoxide. When, however, the oil vapor was also present, so that the diffusion of the water molecules took place against the back pressure of the oil molecules, the action was less rapid. From all chemical data that could be found there was no absorption of the oil vapor, and from the curve the indications are that the oil vapor exerts a definite pressure.

# Electric Light and Power in India*

## British Government Power Survey Reports a Total Installed Rating of 215,509 Kw. and a Total Connected Load of 232,919 Kw.

RECOGNIZING that future industrial development of India depends primarily on the availability of cheap electric power, British India government engineers are making a very comprehensive survey of the present status of the electric light and power industry of that country and are working out a scheme for the acquisition of cheap power by developing the great natural water-power possibilities in the mountainous regions.

Among the industries which are possible of successful development in India if cheap power is available are the following: Electric smelting of indigenous iron ores and the production of steel and its alloys; electric welding, which is at present extensively employed; the production of aluminum from alumina, prepared from the local bauxite deposits; the manufacture of calcium carbide and its numerous derivatives; the direct fixation of atmospheric nitrogen into nitrates of commerce; the electrolytic production of chloride gas, and the preparation of phosphorus and of abrasives like carborundum.

TABLE I—PROBABLE WATER POWERS OF INDIA, SO FAR AS DETERMINED
(Continuous or twenty-four-hour horsepower.)

| Province | Developed and Under Construction, Hp. | Known and Probable Sites, Hp. | Total, Hp. |
|---|---|---|---|
| Assam | ..... | 51,200 | 51,200 |
| Bengal | 600 | 203,600 | 204,200 |
| Bihar and Orissa | ..... | 12,800 | 12,800 |
| Bombay | 85,000 | 258,300 | 343,300 |
| Burma | 14,460 | 439,000 | 453,460 |
| Central Provinces | ..... | 153,000 | 153,000 |
| Cochin | ..... | 25,000 | 25,000 |
| Kashmir | 28,300 | 30,000 | 58,300 |
| Madras | 1,350 | 106,000 | 107,350 |
| Mysore | 32,000 | ..... | 32,000 |
| Northwest Frontier Province | 330 | 20,000 | 20,330 |
| Patiala | 285 | ..... | 285 |
| Punjab | 3,600 | 260,900 | 264,500 |
| Sikkim | 8,000 | ..... | 8,000 |
| Travancore | 530 | ..... | 530 |
| United Provinces and Benares | 5,400 | 32,200 | 37,600 |
| Totals | 179,855 | 1,592,000 | 1,771,855 |

TABLE II—PRIME MOVERS IN ELECTRIC GENERATING PLANTS OF INDIA

| Type of Prime Mover | Public Light and Power Generating Plants, Kw. | Private Generating Plants | Electric Railway Generating Plants | Totals, Kw. |
|---|---|---|---|---|
| Steam | 53,453 | 71,753 | 4,150 | 129,356 |
| Internal combustion engine | 2,392 | 5,064 | 572 | 8,028 |
| Water power | 74,625 | 3,500 | ..... | 78,125 |
| Totals | 130,470 | 80,317 | 4,722 | 215,509 |

In some of these industries the process is electrochemical, in others electrothermal, but in all cheap power and large-scale production are essential to success.

Apart from the ordinary town supply for electric lighting, heating, fans, and to electric tramways and railways for traction purposes, there are many other industries in which electric power would be welcomed if it could compete with other forms of power in cost. One striking instance of this lies in the area of the Duars, within easy reach of water power. The indus-

*An extract from "List of Electrical Undertakings in India," and "Report of Hydro-Electric Survey of India," both issued by the Office of the Electrical Adviser to the Government of India

trial load of this district is about 100,000 hp., much of which is in tea factories, energy being used to run steam engines, but mainly for drying purposes with hot air and fans. Both the motive power and the hot air can be obtained electrically, it being merely a question of comparative costs. Other large tea districts are similarly situated. In Bombay the cotton mills are mostly driven by electric motors, and similar markets for cheap power exist in jute mills, oil mills, the timber-working industry, sugar factories, paper-pulp mills and other industries.

It has always been known that the Indian Empire has great natural water-power possibilities. This potential power has been developed in a few favorable localities to a limited extent, but prior to the war no serious interest had been taken in the subject owing to the limited industrial development of the country. In certain respects India differs from most countries whose natural resources in water power are now being investigated, for the rainfall is seasonal and during many months only occasional thunderstorms break the monotony of dry weather. The variations in rainfall in different parts of the country are enormous, and the departures from the monthly and annual "normals" in any given locality are also very great. As a result of these conditions many of the rivers and streams of India fall to a very low ebb or dry up altogether in their headwaters before the end of the dry season. Where these conditions are prevalent development by monsoon storage is the only method of getting continuous power, and this is not possible in most localities.

SIMLA MUNICIPAL HYDRO-ELECTRIC PLANT ON THE NAVTI RIVER, CHABA—HEAD 540 FT., INSTALLED RATING 1,250 KW.

TABLE III—BRAKE HORSEPOWER INVOLVED IN VARIOUS INDUSTRIES OF INDIA.

About 310,500 hp., or 27 per cent of the total, is electrical. The figures are only approximations and outside of the Province of Bengal are very incomplete.

| | |
|---|---|
| Assam | 22,550 |
| Bengal, exclusive of Calcutta area | 25,318 |
| Calcutta area | 176,200 |
| Bihar, apart from collieries, etc. | 2,325 |
| Bombay Presidency | 32,872 |
| Bombay City area | 750,000 |
| Burma, exclusive of rice mills, etc. | 17,750 |
| Central Provinces | 32,773 |
| Madras | 39,568 |
| Northwest Frontier Province | ... |
| Punjab (steam only) | 15,734 |
| United Provinces | 38,548 |

The perpetual snows of the Himalayas are responsible for the hot-weather flow in most of the perennial rivers of northern India and may prove an asset of immense value for industrial power, just as they already are for irrigation. Even the comparatively low-lying snows will last well into the hot weather, feeding the springs and keeping up the volume of water. There is, however, very little of this "white coal" in other parts of India, and such perennial streams as exist are spring-fed.

The present water-power development in India and the probable potential water powers, so far as determined by the government investigation, are given in Table I. The water powers of the country have hardly been touched, and large additions to those developed may be expected in the near future.

Table IV gives detail figures on the electric light and power plants in India in 1917. There were 133 electric generating plants, of which 105 were private or isolated plants. The twenty-eight plants generating energy for public use, however, reported an installed rating of 130,470 kw. as against 80,317 kw. for the private plants. The total connected load of the public plants was also almost twice that of the private plants. Table II lists the prime movers installed in the three classes of electric generating plants. It is of special interest to note that in 1917 more than 57 per cent of the plants generating energy for public use were operated by water power.

Early in the power investigation inquiries were set on foot to ascertain the approximate power installed in various industries and localities in India. The total electrical energy generated was only 550,000,000 kw.-hr.

TABLE IV—ELECTRIC LIGHT AND POWER GENERATING PLANTS OF INDIA

| | Light and Power Generating Plants, Public | | | | | | | Private Generating Plants | | | | Installed Generator Rating of Electric Railway Stations, Kw. | Total Installed Generator Rating of All Plants, Kw. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Provinces | Number of Plants | Installed Generator Rating, Kw. | Total Connected Load, Kw. | Peak Load, Kw. | Number of Customers | Kilowatt Hours Generated | Kilowatt Hours Sold | Number of Plants Over 200 Kw. | Number of Plants Under 200 Kw. | Installed Generator Rating, Kw. | Total Connected Load, Kw. | | |
| Madras | 2 | 8,000 | 6,677 | 2,070 | 2,305 | 7,634,400 | 5,693,800 | 7 | 14 (1912) | 4,283 | 5,626 | ..... | 12,283 |
| Bombay | 5 | 59,672 | 69,981 | 46,894 | 10,377 | 123,000,000 | 108,355,000 | 18 | 130 (1912) | 11,315 | 11,270 | ..... | 70,987 |
| Bengal | 5 | 22,057 | 36,860 | 9,287 | 10,771 | 32,008,000 | 23,806,000 | 41 | 80 (1912) | 33,514 | 36,000 | 4,150 | 59,721 |
| United Provinces | 7 | 5,305 | 4,174 | 2,556 | 3,913 | 5,768,000 | 5,014,000 | 4 | 47 (1911) | 1,260 | 843 | ..... | 6,565 |
| Punjab | 4 | 2,375 | 3,959 | 1,409 | 3,280 | 4,596,000 | 3,712,000 | 2 | 16 (1912) | 2,825 | 6,715 | ..... | 5,200 |
| Delhi | 2 | 761 | 1,166 | 668 | 2,223 | 1,993,500 | 1,197,000 | 1 | 5 (1912) | 200 | 175 | ..... | 961 |
| Burma | 2 | 5,850 | 6,244 | 2,541 | 4,217 | 7,866,000 | 6,075,000 | 8 | 60 (1912) | 3,360 | 2,878 | 572 | 9,782 |
| Central Provinces | 1 | 250 | 470 | 96 | 174 | 209,000 | 182,000 | 4 | 28 (1912) | 3,510 | 3,495 | ..... | 3,760 |
| Assam | .. | ..... | ..... | ..... | ..... | ..... | ..... | 1 | 17 (1912) | 200 | 180 | ..... | 200 |
| Bihar and Orissa | .. | ..... | ..... | ..... | ..... | ..... | ..... | 19 | ... | 19,850 | 15,206 | ..... | 19,850 |
| Native States | .. | 26,200 | 21,000 | 15,960 | ..... | 102,560,000 | ..... | .. | ... | ..... | ..... | ..... | 26,200 |
| Totals for India | 28 | 130,470 | 150,531 | 81,481 | 37,260 | 285,634,900 | 154,034,800 | 105 | 397 | 80,317 | 82,388 | 4,722 | 215,509 |

# Some Grounding Chains Are Inadequate

## Galvanizing a Source of Trouble Due to Low Melting Point of Zinc—Tension on Chains Necessary to Obtain Results—Effect of Copper Plating

By ALFRED HERZ
*Engineer of Electrical Tests, Public Service Company of Northern Illinois*

IRRESPECTIVE of the most thorough tests of material and the use of the best engineering and operating skill, mistakes and accidents are apt to occur while high-tension lines are being worked upon if no precautions are taken. To prevent this the practice has been to short-circuit and ground the part of the line on which work is being done. The three main reasons for this form of protection are:

1. To give immediate indication of whether the section of line about to be worked on is actually disconnected from all sources of energy.
2. To prevent injury to men working on high-tension lines if such lines be accidentally connected metallically or inductively to a source of energy.
3. To clear the section of line under repair from voltages due to atmospheric and similar causes.

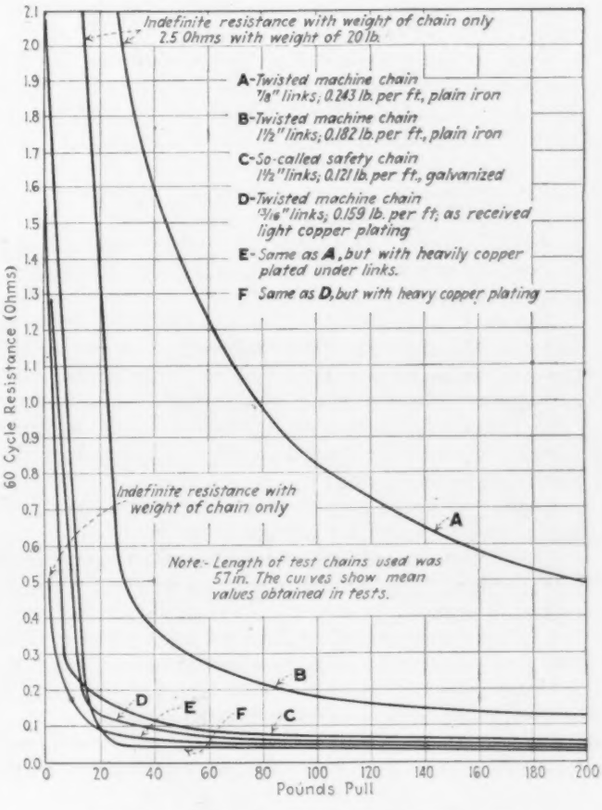
Aside from performing the above duties, a good shorting and grounding device should, if it is to be portable, be such as can be compressed into a small space; should be comparatively light if the transmission lines are located where vehicle access is difficult; should be easy to apply to the line, and should slide readily over the line at the time of its application or removal. The current-carrying capacity should be high and the junk value small to minimize stealing.

Up to this time it has seemed that any chain applied in any manner was deemed ample. The writer has felt that such haphazard methods are not in accord with modern practice in other lines and might not be at all adequate to handle the currents involved in modern transmission systems. To this end a series of tests were made, using some iron chains easily obtained in the market but not commonly used as short-circuiting chains, and some that were actually in use. For instance, in a certain case the common practice has been to use a galvanized chain, such as is used for hanging (raising and lowering) arc lamps, for a shorting and grounding chain. This was submitted to test with the result as indicated by curves. Chains as received from the manufacturer were submitted to the following tests:

(a) Current-carrying capacity (fusing current).
(b) Resistance relative to tension on the chain.
(c) Effect of weather protection (plating, etc.) on the resistance and fusing current.

In carrying on these tests one surprising fact that became apparent immediately was that galvanizing the chain reduced the current-carrying capacity for heavy currents, the chain actually catching fire or causing a mild explosion when sufficient load was applied, even though this load was considerably below the melting point, or even bright-red heat of the iron, of which the chain is made.

This can be readily explained by the fact that the zinc coating (galvanizing) has a comparatively low ignition temperature, this in turn igniting the iron and bringing about the results mentioned. For instance, the test


Indefinite resistance with weight of chain only
2.5 Ohms with weight of 20 lb.
A-Twisted machine chain 7/8" links; 0.243 lb. per ft., plain iron
B-Twisted machine chain 1½" links; 0.182 lb. per ft., plain iron
C-So-called safety chain 1½" links; 0.121 lb. per ft., galvanized
D-Twisted machine chain 7/8" links; 0.159 lb. per ft; as received light copper plating
E-Same as A, but with heavily copper plated under links.
F Same as D, but with heavy copper plating
Indefinite resistance with weight of chain only
Note-Length of test chains used was 57 in. The curves show mean values obtained in tests.
60 Cycle Resistance (Ohms)
Pounds Pull
0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0 2.1
0 20 40 60 80 100 120 140 160 180 200
A
B
C
D
E
F

RELATION BETWEEN CHAIN RESISTANCE AND TENSION IN POUNDS

It will be noted that with chain "E," which is same as chain "A" but heavily copper-plated under links, the resistance curve bends more sharply and shows considerably lower resistance than in test of chain "A."

report says: "The chain separated in less than one minute when subjected to 250 amp. at 60 lb. (27 kg.) dead weight. It was further noted that the chain practically caught fire owing to the zinc coating rapidly oxidizing."

Irrespective of the material of which the chain is made, the tension on it affects its electrical resistance to a great extent.

I do not wish to convey the idea that the material itself has no relation to the resistance, but I do wish to emphasize that the material between which contact is made in the links and the pressure applied have a considerable bearing on the total resistance. For instance, a certain bright iron chain as received had, when submitted to a 100-lb. (45-kg.) pull, a resistance of 0.8 ohm for a certain length. This same chain heavily plated with copper, especially under the links, had one-sixteenth of this resistance with the same pull. When the bright iron chain was submitted to a 200-lb. (90-kg.) pull, it had ½-ohm resistance, which was re-

duced to one-tenth of this value after plating with copper.

The results obtained on these tests are set forth in the accompanying set of curves, showing the relation of resistance to pounds pull, and clearly demonstrate what I wish to repeat here: that when a chain is used for short-circuiting and grounding purposes it must be continuously submitted to tension while in use. This should be especially watched since the chain might stretch while heated. Noting any of the curves, it becomes apparent that although a short length of chain was used on these tests—about 6 ft. (1.8 m.)—the weight of the chain plus connections was not sufficient to bring the resistance within reason.

Take tests *A*, *B* and *E*. These show an indefinite resistance until the chain is submitted to some tension. These same chains, after being plated with copper, still have unreasonable resistance until a tension of about 30 lb. (13.6 kg.) is applied, after which the chain assumes the characteristic of a solid conductor and can be depended upon to furnish satisfactory means for carrying current. I believe the curves are extremely interesting and I do not recall seeing any other data of a similar nature.

The chains submitted to test were all iron chains and had varying physical characteristics. The curves show the resistance of chain "A" after being copper-plated and chain "D" after being heavily replated with copper.

As to the fusing current, the following tabulation will indicate the result obtained on 9 in. (22.8 cm.) of chain subjected to 60-lb. pull:

Chain "A" broke open in two minutes and twenty-nine seconds while carrying 300 amp.

Chain "B" opened in five minutes when carrying 240 amp.; opened in one minute and five seconds when carrying 300 amp.

Chain "C" separated in four minutes when carrying 180 amp.; separated in forty-eight seconds when carrying 300 amp. and caught fire; carried 1,400 amp. for one and two-tenths seconds; explosion resulted.

Chain "D" opened in thirty-nine seconds when carrying 290 amp. without any undue commotion; carried 1,750 amp. for four seconds; opened without any commotion.

### COPPER-PLATED CHAIN SELECTED

From the foregoing it is clear a compromise must be made. This was done in our case by adopting the heavily copper-plated chain "D" as our standard, it being the chain which most nearly conformed to our ideals as to weight, small compass, current-carrying capacity, smooth riding quality, etc. We adopted a somewhat shorter length than usual for our work, since considerable mileage of our high-tension lines is overbuilt with ground wires. We therefore adopted 25 ft. (7.5 m.) as the standard length, and expect linemen to attach a good hand line on each end of the chain. Chain "D" is actually known to the trade as No. 3 twisted machine chain. For our work it is heavily plated with copper, especially under the links.

If for any reason longer lengths of chain are necessary, such as would be the case on lines not overbuilt with ground wires, several of these 25-ft. lengths can be attached to each other very readily by means of bare No. 6 or No. 8 copper wire.

Chains that are slack are worse than no protection at all, since men are liable to obtain a mistaken notion that they are being afforded protection against potential, which is not the case. In a recent conversation with a man who has traveled considerably and witnessed and done considerable high-tension work my assumption of the treachery of loose chains was verified. On the other hand, a recent case comes to my mind where the chain adopted and correctly applied has successfully withstood the brunt of being directly shorted on a system of high-tension lines within a comparatively short distance of a 10,000-kw. low-reactance transformer bank.

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# Baltimore System of Leaving Meters Alive

## Practice of Not Disconnecting Vacated Residences Has Been Both a Service to the Public and a Source of Saving for the Company

BY R. F. BONSALL

Manager General Service Department Consolidated Gas, Electric Light & Power Company, Baltimore, Md.

FOR some years in Baltimore we have been studying and applying recognized business methods in our commercial and operating relations with our customers. In every way possible we have cut red tape in the endeavor to promote a better feeling on the part of the public served. One of the most successful things accomplished has been to stop disconnecting vacated residences.

About seven years ago we decided there was no practical difference between selling merchandise and electricity, where the current and meter were on the premises. Since then we have not disconnected the service and removed the meter when a customer has notified us to "discontinue the service as we are vacating the premises." In deciding on such a policy, we appreciated that there would be a loss representing current registered on the meter while the premises were vacant. We believed, however, that this loss would be more than offset by a better feeling on the part of our customers, to say nothing of a better work distribution by operating departments and less record keeping.

The plan inaugurated, which has been in operation since 1915, consists of leaving the electric service alive in residences, apartments and small stores having an installation of less than 1 kw. By this I mean that once having established connection the service is available for the inspection of premises by prospective tenants and can be used by the new tenant, regardless of the fact that the previous tenant has moved away and ordered the service "discontinued."

When such an order is received we read the meter, which, of course, permits us to render the old customer a bill to the date on which he ordered the service discontinued and leave the service alive to the lamp or appliance, marking the meter sheet in the meter reader's route book as "premises vacant." The meter sheet remains in the route book, necessitating the meter reader seeing that particular meter or checking up the fact that the house is vacant each month on his regular rounds. This condition continues for a period of nine months, when if there is no application for the service the meter is removed on an order issued by the billing department. In our company the meter department is responsible only for the setting and removing of meters and the accuracy of registration on the premises.

Our business office is equipped with an application counter provided with a card file for each premises or apartment where service has been supplied, is supplied

or is available. Upon application being made in person, the card file is referred to for data on the service condition or any other information which may have been placed thereon, such as "wiring unsafe," or "certificate withheld." If conditions are satisfactory, the customer's application is taken. Where request is made by mail or phone, the same reference is made to the card file. If conditions are all right, an order is issued to read the meter and at the same time obtain the customer's signature to the order, which then becomes the application. Such a proceeding refers to the class of premises previously mentioned and not to large stores or business places, and only to those locations where service is available. Where a service loop is necessary, orders are issued on the operating departments.

The application is given to one of a crew of men working directly from and under authority of the application department, and he is told to read the meter. His report that he has done so (he marks meter index and date on back of application form) is authority to the billing department to open or close the account at the index reported by the application department. There is no delay in connecting the service, as the new tenant finds it available when he moves in, and he is billed only for the energy used from that time.

### How Unoccupied Premises Are Checked

Should the customer fail to notify us of his occupancy, it is discovered by the meter reader on the following meter-reading date, at which time he reads the meter and places the index on the meter sheet which has been left in the route book. This serves as a notice to the billing department that the premises are occupied. They in turn notify the application department to obtain the necessary application and credit data.

For the purpose of checking credit, applications taken at the counter or reported by the men on the street are sent to the credit department hourly and returned hourly. Cases held for investigation are so noted at the application counter, but 98 per cent of all applications taken are cleared completely within forty-eight hours. The operation of our system, with service always connected and available, makes it unnecessary to carry a large force in order to complete orders in the afternoon which are taken in the morning.

Orders for the termination of service are handled in the same way. They are given to the same crew of men who read the meters, and their reports are authority to the billing department to discontinue an account and mark on the meter reader's handbook that the premises are vacant. In cases of "termination" a tag is hung on the meter stating that service is available and asking that the company be notified that these premises have been occupied. "Telephone St. Paul 8000," we make our slogan. This tag is removed when the man calls to read the meter.

This plan, in addition to its effect on the public, we find of material advantage to the operating departments, inasmuch as they do not have to bother with change-of-name orders, which usually constitute a large percentage of the orders issued. It also means that the application department's crew does not have to be equipped with special automobiles in order to carry equipment quickly. It is furnished only with fuse blocks, a pair of pliers and sealing irons, and the men make better time by using street cars. They complete an average of thirty-five calls a day at a cost of about 18 cents each, as compared with the former practice of handling the same orders through the operating departments, with the necessary exchange of orders, carbon copies, and so on, at a cost of approximately 75 cents. This arrangement is also flexible and simple.

It is economical and profitable, and several of the other larger companies have adopted this plan, although many others have feared that the loss of unaccounted-for energy would be prohibitive. Here is the actual

All the New Tenant Has To Do Is Call St. Paul 8000
How the Baltimore Customer Is Saved Annoyance
THIS METER SEALED CALL ST. PAUL 8000 TO HAVE THE GAS TURNED ON
In Baltimore—when home is vacated, gas meter is turned off and tagged. Electric service is always available.
In may other cities—both gas and electric service is discontinued. Meters are taken from home in some cities.
In Baltimore—a telephone call is all that is necessary to have gas service in new home. Electric service is always available.
In many other cities—it is necessary to make personal application before one secures gas or electric service.
In Baltimore—man reads gas and electric meters—turns on gas. Electric service is always available.
APPLICATION DPT.
CREDIT DATA
METER DPT.
In many other cities—time is lost while application is going through various departments, resulting in delayed service.
In Baltimore—new tenant moves into new home; gas and electric service facilitates moving—customers pleased with service.
In many other cities—new tenant moves into dark house while application for service is held up through red tape.
In Baltimore—customers sometimes write or call at office to express appreciation of Company's handling of requests for service.
In many other cities—red tape results in dissatisfaction on the part of customers, waiting for illuminating service.

TAG HUNG ON METER WHEN PREMISES ARE VACATED

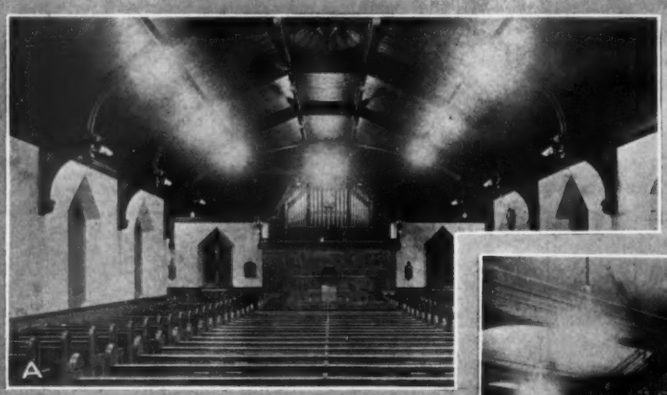
record of registered but not chargeable kilowatt-hours on the lines of the Consolidated Gas, Electric Light & Power Company in kilowatt-hours:

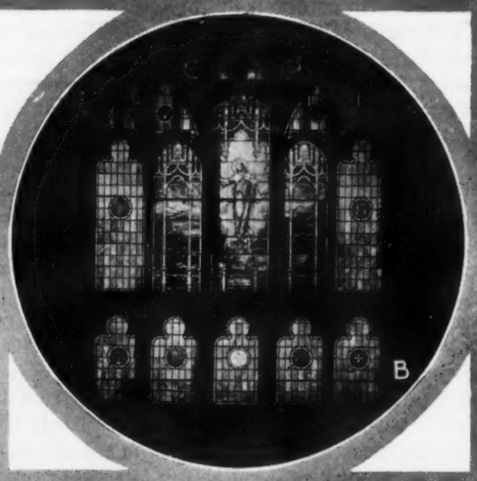
| 1915 | 1916 | 1917 | 1918 | 1919 | 1920 | 1921* |
|---|---|---|---|---|---|---|
| 3,957 | 3,177 | 2,337 | 2,459 | 4,988 | 5,862 | 2,093 |

*For first nine months.

Figured at the cost of manufacturing energy per kilowatt-hour, the amount of loss is negligible as compared not only with the good will gained but also with the lower cost of operation, to say nothing of valuable flexibility. We have had no reason to regret the adoption of our present policy as applied to our 88,000 customers. The accompanying illustration reproduces a card which we have used to impress upon the public the many conveniences which the system brings to the new tenant in Baltimore. It extends a welcome to the new customer in a very practical and much-appreciated form. It also often aids the real estate man and owner to rent the house more quickly and puts the meter back at work.

# Types of Church Illumination Which Have Been Found Effective


A


B

C

D

E

A—Direct lighting furnished by 150-watt bowl-frosted "Mazda C" lamps in dense opal-bowl reflectors, on 18-ft. x 14-ft. centers.

B—Stained glass window illuminated by floodlight.

C—General illumination is furnished by 500-watt "Mazda C" lamps in inverted mirrored-glass reflectors; at capitals in smaller angle units are 75-watt lamps. Concealed units illuminate baptismal pool.

D—The four large central bays are illuminated with 500-watt "Mazda C" lamps; while above the balcony are eight similar fixtures equipped with 200-watt units.

E—Deep-bowl mirrored-glass reflectors are recessed at crossings of arches and equipped with 200-watt and 300-watt units. Small inverted units at capitals and upper corbels afford indirect lighting.

F—Multiple-unit fixture containing four 150-watt "Mazda C" lamps in deep-bowl mirrored-glass reflectors on 15-ft. x 26-ft. centers hung 40 ft. above floor. Downward light diffuses through glass plate.

F

# A Field for Greater Co-operation Between Architect and Engineer

## Because of Varied Design the Lighting of Churches Cannot Be Standardized and More Than Usual Attention Must Be Directed to Artistic Effects—Conditions Encountered and Schemes Employed

By A. L. POWELL
*Edison Lamp Works, Harrison, N. J.*

LIGHTING of churches cannot be standardized, like the illumination of industrial plants, offices or stores, because places of worship vary widely in design and hence demand special attention to the artistic effects. For this reason in any discussion of the subject only the conditions likely to be encountered and schemes which have proved satisfactory in service can be outlined. The essential requirement is that there shall be early co-operation between the architect and the illuminating engineer. Best results cannot be obtained if the engineer does not have an opportunity to suggest modifications in design that will help the illumination effect.

In the church, in contrast to the theater or assembly hall, the lights are turned on the entire time that the congregation is present, so that particular attention must be paid to the arrangement of lighting units, concealing the lamps from view or equipping them with diffusing glassware. The lighting units should be in architectural conformity with the structure, yet the utility of the lighting must also have consideration. Every precaution should be taken to prevent eye strain, which leads to drowsiness and attendant discomfort, and enough light should be provided in all parts of the room to make reading easy. Experience has shown that, if there is no annoying glare or bad contrast, an intensity of from 0.75 foot-candle to 1.5 foot-candles is sufficient for reading at short intervals, as, for instance, during the singing of hymns or psalter responses. It is impracticable to specify the wattage necessary to obtain the desired illumination or give figures on the utilization constants for the different systems suggested owing to the wide variation in character of surroundings. The illustrations show some typical examples, and these, with the data presented in the bibliographical references, indicate the range of values which have been applied.

### METHODS TO AVOID IN CHURCH LIGHTING

Huge chandeliers, unless very carefully designed, have no architectural significance, and as ordinarily employed they create severe glare. The tendency seems to be to hang these fixtures too low and use a large number of small lamps. With this arrangement it is almost impossible to avoid glare, and many a church otherwise pleasing is spoiled by such lighting. In a number of instances fixtures originally intended for gas jets or low-powered lamps have been modified to accommodate the brilliant high-efficiency modern lamp and are decidedly objectionable. Where such fixtures are employed special precautions must be taken to see that the light sources are of low brilliancy.

Studded lights around the capitals of the pillars, along the beams and on the corbels are also objectionable, for it is almost impossible to avoid the casting of annoying shadows. While this system sometimes brings out the architectural beauties of the building, it is difficult to maintain, and each burned-out lamp will make a break in the continuity and spoil the effect sought. The use of this system will occasionally produce freak effects. For instance, a row of small lamps around the capital of a pillar may give the appearance of an open space and leave the roof and its arches without visible means of support. The efficiency of this system is low and renewal cost high.

Bracket units at the front of the church and decorative lighting around the pulpit and organ are particularly objectionable, for any one giving attention to the speaker will be looking toward these bright spots. This is one of the most common causes of unsatisfactory church lighting.

### FEASIBLE SCHEMES OF LIGHTING

*Ritualistic Churches.*—In many cases the ceiling of a ritualistic[1] church is too dark in color to warrant the use of an indirect system of lighting and the nave and transept must be lighted by direct overhead units. The following systems of lighting are applicable to the ritualistic church with dark surroundings. Buildings with light surroundings can be well lighted by the methods discussed below under "Evangelical Churches."

1. Direct-lighting fixtures consisting of clear gas-filled lamps and reflectors inclosed in some sort of ornamental house. This can be made up of art glass and wood or metal work in the form of a lantern to inclose one or more units (see opposite page). The multiple-unit fixture offers certain advantages in that the failure of one unit will not leave an entire section in shadow. Mirrored-glass reflectors are excellent here, but must be supplemented by a few low-wattage lamps inside of the fixture to illuminate the art glass. Translucent, prismatic or dense opal reflectors are also effective, and the transmitted light serves the purpose of the small lamps. Such fixtures as these can be relatively large

[1]Churches fall in two distinct groups—the ritualistic and the evangelical. In the former the sanctuary or altar is the center of attraction and symbolically demands the higher intensity of illumination. In the evangelical church the speaker, pastor or minister is symbolically the representative of the divine power and demands the higher illumination. The very structure of the buildings devoted to these two groups still further separates their lighting requirements. The ritualistic church is generally of the Gothic type of architecture with the nave and transept forming a cross. A high peaked roof is also characteristic of this form of structure, and dark surroundings are likely to prevail. In the evangelical church the basilica type of structure is frequently followed. The ceiling is more likely to be light in color and also flatter. Even where the Gothic style of architecture is employed in these churches, it is usually modified and presents less of a lighting problem.

when suspended from the peak of the arch or smaller in size when dropped from the hammer beams.[2]

2. Bowl-frosted "Mazda" lamps in simple direct-lighting opalescent-glass reflectors can be suspended from the hammer beams and form a very inexpensive method of lighting. If possible, a Gothic type of decoration should be secured. This scheme, with a different arrangement, is pictured on page 180. As an alternative to open-type reflectors, simple types of inclosing globes of Gothic design can be used in the same position. Opalescent glass, of course, gives good diffusion, but the whiteness of the glass shows up in contrast with the background. It is desirable, therefore, to employ units with a spray of light brown or similar color. The slight absorption of the toning is offset by the improved appearance of the installation.[3]

3. Direct-lighting angle or symmetric reflectors, with clear "Mazda" lamps, can be placed behind the hammer beams, sending the light downward. These should be on the side toward the altar, not in the general view of the congregation, and if the proper type of reflector is chosen, they will not be annoying to the speaker.[4]

4. In the Gothic structure, with light surroundings, a combination of direct and totally indirect lighting is often applied with excellent results, as indicated on page 180. In this building the utilization of light from an indirect system would be of a very low order owing to the great height in comparison with the width. Direct-lighting reflectors are recessed at the crossing of the arches, and the indirect units eliminate severe contrasts in brightness.

*Evangelical Churches.*—Since the ceilings of many evangelical churches are light in color and nearly flat, there is considerable latitude in the choice of lighting equipment. In contrast with the pure Gothic structure, all three systems of illumination—direct, semi-indirect and totally indirect—have their uses. Frequently the architectural features of the building offer certain logical places for the attachment of lighting fixtures, at the crossing of the nave and transept, for example, or at symmetrical points along the main peak. Balance is usually desirable in the location of outlets.

Many forms of direct-lighting devices suggest themselves. They should generally be of the inclosed, rather than the open, type, as the likelihood of glare is then diminished. Decorated opalescent glass, parchment and painted mica are among the materials which can be effectively used for this purpose. A very wide latitude exists in the choice of equipment. The funds available for fixtures will govern this factor. As an example of extreme simplicity, inexpensive inclosing units with clear "Mazda C" lamps can be placed at the apex of the arches separating the side aisles from the main aisle in the modified Gothic structure. A sufficient spread of light will be obtained and lighting units will be well out of view.

Semi-indirect units symmetrically spaced are applicable to the church with a light-colored ceiling and are available in a wide variety of decorations which will harmonize with the architectural design. The character of illumination which can be obtained when this system[5] is employed is indicated on page 180.

Totally indirect illumination can be accomplished in a number of ways. Hanging ceiling fixtures with clear "Mazda C" lamps in mirrored-glass reflectors concealed by an appropriate decorated housing are inexpensive and relatively simple to install. Smaller lamps in mirrored-glass individual or trough reflectors can be placed in a cornice, or groups of such units may be placed in recesses at the tops of the columns or capitals.[6] Wall boxes with suitably designed mirrored-glass reflectors have also been employed for this method of lighting. Occasionally recessed windows offer logical locations for such equipment. A novel method of indirect illumination is used in one church where deep recessed boxes are used at the front of the balcony, these boxes being so shaped as to confine the light to the ceiling and avoid "spill" light on the walls.[7]

Many churches are provided with an art-glass ceiling to admit natural light. Excellent artificial illumination can be accomplished by properly placing direct-lighting reflectors and clear "Mazda C" lamps above the skylight. Where the skylight is limited in area it is often necessary to supplement illumination received from this by overhead units placed between it and the side walls. A combination of semi-indirect or totally indirect illumination and the diffused direct light through the sky window proves effective.

For balconies the general overhead lighting of the auditorium will usually take care of the balcony itself. Lighting beneath the balcony can be accomplished by the use of the wall-type indirect lighting box previously mentioned, close ceiling hemispheres or flat plates attached to the lower side of the balcony. The glass should be of an opalescent character giving good diffusion with minimum absorption.

In order that the minister or speaker shall be illuminated to a higher degree than the body of the church, it is desirable to have some means of projecting light on the pulpit. The suspension-type spot lamp with a concentrated-filament "Mazda" unit is compact and can be hidden from view. One of these units placed above the speaker will produce the desired result. It should be focused so that a rather spread (not sharply defined) spot is obtained.

On account of the desirability of concentrating the attention on the elaborate ritual in the sanctuary, this must be the most brightly lighted portion of the church, and yet no lights should be visible, for the congregation faces in that direction. In the Gothic structure there is usually an excellent opportunity for placing the units behind the chancel arch. Angle-steel or mirrored-glass angle reflectors simplify the problem remarkably.

The sanctuary should have plenty of light to bring

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[2] "Relighting an Old Church," by W. J. Wheeler, *Lighting Journal*, January, 1917; "A Rather Novel Method of Church Illumination," by J. L. Stair, *Lighting Journal*, January, 1914; "Lighting a Cathedral at Albany, N. Y.," by J. W. Mackie, *Lighting Journal*, April, 1916.

[3] "Church Lighting," by A. L. Powell, *General Electric Review*, February, 1914; "Improved Lighting of a Well-Known Church," by A. L. Powell, ELECTRICAL WORLD, Nov. 14, 1914.

[4] "A Problem in Church Lighting," by A. H. Ford, *Lighting Journal*, July, 1913; "A Semi-Concealed Church Lighting Installation," ELECTRICAL WORLD, Dec. 30, 1909.

[5] "A Pleasing Church Installation," by A. L. Powell, *Lighting Journal*, February, 1914; "Lighting of a Church Basement," by R. Simpson, *Lighting Journal*, September, 1913.

[6] "Lighting Installation for a Church Auditorium," by H. O. Stewart, *Electrical Review*, July 5, 1919; "A Unique Method of Lighting a Church of Unusual Architecture," by J. C. Stehley, *Lighting Journal*, June, 1913; "Modern Illumination in Churches," *Lighting Journal*, January, 1913; "Concealed Lighting That Emphasizes the Architectural Features of a Cathedral Interior," by J. L. Stair, ELECTRICAL WORLD, July 8, 1916; "Lighting a Church of the Basilica Type," *Electrical Review*, Sept. 30, 1916; "Lighting the Church of St. John the Divine, New York," by W. H. Spencer, *Illuminating Engineer*, May, 1911; "Effective Illumination Scheme of Holy Trinity Church, New York," ELECTRICAL WORLD, March 2, 1912, and *Illuminating Engineer*, March, 1912; "Indirect Lighting in Auditoriums," by H. B. Wheeler, *Transactions I. E. S.*, Vol. 7, page 163; "Examples of Church Lighting Installed by a Central Station," by W. R. Moulton, *Lighting Journal*, June, 1915.

[7] "Illumination of St. George's Episcopal Church, Newburgh, N. Y.," by A. L. Powell and R. B. Thompson, ELECTRICAL WORLD, Feb. 26, 1916.

out its decorative value, and yet the altar should not be uniformly bright, for shadow effects are then lost and the elaborately carved portions appear flat and dull, with consequent absence of detail. It is usually better to light the altar from the sides, simulating the daylight values, rather than from the top, to avoid any deep shadows without entirely eliminating them.

The lamps should be so arranged that the choir stalls are well illuminated, and it is often desirable to have the units on several switches, to meet the demands of the different portions of the services.[8]

In the synagogue the scroll kept in a cabinet at the rear of the altar should be illuminated by a few low-wattage lamps placed to furnish uniform illumination. A switch turning these on automatically as doors are opened is a desirable accessory. An outlet above the altar for a low-wattage lamp for the "Light Everlasting" and convenience outlets for the imitation candlesticks on the altar are also necessary features.

### Choir Loft Presents Problem

In the evangelical church the choir loft occasionally presents a problem. Often it is at the front of the church. The light from the main auditorium units is low in intensity and comes from the wrong direction. A practice often followed is to place a few brackets on the organ and shield the lamps with some sort of diffusing shade.

These units are continually in the vision of the congregation and are extremely annoying. One solution is to place the lamps in recessed boxes in the overhanging portion of the organ and diffuse the light through glass plates. If the organ structure will not permit of this, recourse has been made to bowl-shaped steel reflectors painted on the outside to harmonize with the organ finish and used on brackets. While these are not especially decorative, a strong light is provided on the books of the choir, and as the reflectors are opaque, the eyes of the congregation are protected. Reading lamps on music racks, as in the orchestra pit of a theater, are also applicable and possess many advantages.

A local lamp is, of course, provided for the organist, and in many instances it is advisable to have a low-candlepower lamp below the keyboard to illuminate the pedals. All these lamps should be separated from the main circuits and readily controllable during rehearsals.

### Make Stained-Glass Windows Attractive by Night and Day

Most churches have at least one elaborate stained art-glass memorial window, which can be made a thing of beauty at night as well as day. For this purpose weatherproof-type, enameled-steel angle reflectors with clear lamps have proved of use. In most cases it is necessary to make a point-by-point illumination calculation to determine the type of unit and its location for the even distribution of light, and this can often be supplemented by some slight experimentation to determine the final result.

As a general rule, the window should be evenly illuminated, and it is bad practice to have the light source visible through the glass. Sometimes, however, there is a point in the design which logically demands a higher intensity of light, as, for example, the sky in a landscape scene, and this feature must have attention, as evidenced by Fig. 7, where the Saviour is the most brilliant spot.

For large windows a very effective method is to project from a distance a beam of light having sufficient spread to cover the entire window area with a uniform intensity. There are available weatherproof floodlighting projectors which are especially applicable to this class of work. They can be mounted on a post or other convenient location, from 25 ft. to 300 ft. (7.5 m. to 90 m.) from the window, the beam being trained on the window and its spread varied as necessary. The 500-watt unit is sufficient to cover 20-ft. (6 m.) windows with the unit mounted, 100 ft. (30 m.) away.[9]

### Suggestions Regarding Wiring

In many respects the demands of the church are similar to those of the theater, and it is advisable to have a conveniently located central control. Dimmers are an especially desirable feature, both on the main and chancel circuits. During the sermon the dimming of lights produces an excellent effect.

An experiment with colored lighting is now being carried on in St. Mark's Church in the Bowery, New York City.[10] Direct-lighting lantern-type fixtures are used to produce red, amber, blue and green-toned illumination. During the prayer one combination is employed, during the sermon another, at the offertory still another, and so on. The psychological effect is taken into consideration at each point, blue and green for meditation, red and amber for stimulation and so on. There are undoubtedly wonderful possibilities in this, and the future will see great developments. Such manipulation of the light requires a number of circuits with the necessary switching and dimming controls.

Standard convenience outlets at certain points about the building are a necessity. In some churches entertainments are given requiring the use of a stereopticon. A stage pocket at the rear of the auditorium with sufficient capacity for the lantern is a feature worthy of attention. On various occasions decorative lighting is called into play, as, for example, at Christmas time when a tree might be illuminated by small lamps. A receptacle on the rostrum or stage is necessary for such occasions.[11] Many clergymen use notes, and a reading lamp giving a strong localized light is often necessary.

A feature often overlooked in designing a lighting system is the fact that reflectors and lamps become covered with dust, which very materially reduces the light output. In many cases complaints of poor illumination are due to this cause alone. In the church, with its high ceiling, fixtures are very likely to be most inaccessible, and the sexton hesitates to risk his safety for the sake of cleaning the lamps. If one wishes the installation to give continuous satisfaction, he should keep the question, "will it be easy to clean reflectors and replace burned-out lamps?" constantly in mind. Equipment should be installed so that it is directly accessible or lowering devices should be provided. Automatic cutout hangers are of assistance here, and suitable windlasses for massive fixtures are a necessity.

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[8] "Chancel Lighting," by R. B. Ely, *Lighting Journal*, January, 1913; "Electricity Versus Wax in Religious Work," by Roscoe Scott, *Electrical Review*, Feb. 3, 1912.

[9] "Light the Church Windows," by J. R. Colville and D. S. Myers, *Electrical Merchandising*, November, 1921, and *Electrical Review*, Dec. 10, 1921; "Lighting Opportunities in Stained Glass Windows," by Roscoe Scott, *Electrical Review*, June 9, 1917; "Church-Window Floodlighting," by A. O. Davis, *Lighting Journal*, October, 1916.

[10] "Illumination Features of St. Mark's," *Electrical Review*, Dec. 17, 1921.

[11] "Special Lighting Effects for Christmas Entertainments," by A. L. Powell, *Electrical Merchandising*, November, 1919.

# Light and Power Stocks Take Upward Turn

### Marked Stability Has Been Shown by These Securities in Comparison with the Fluctuations of Industrials and Rails

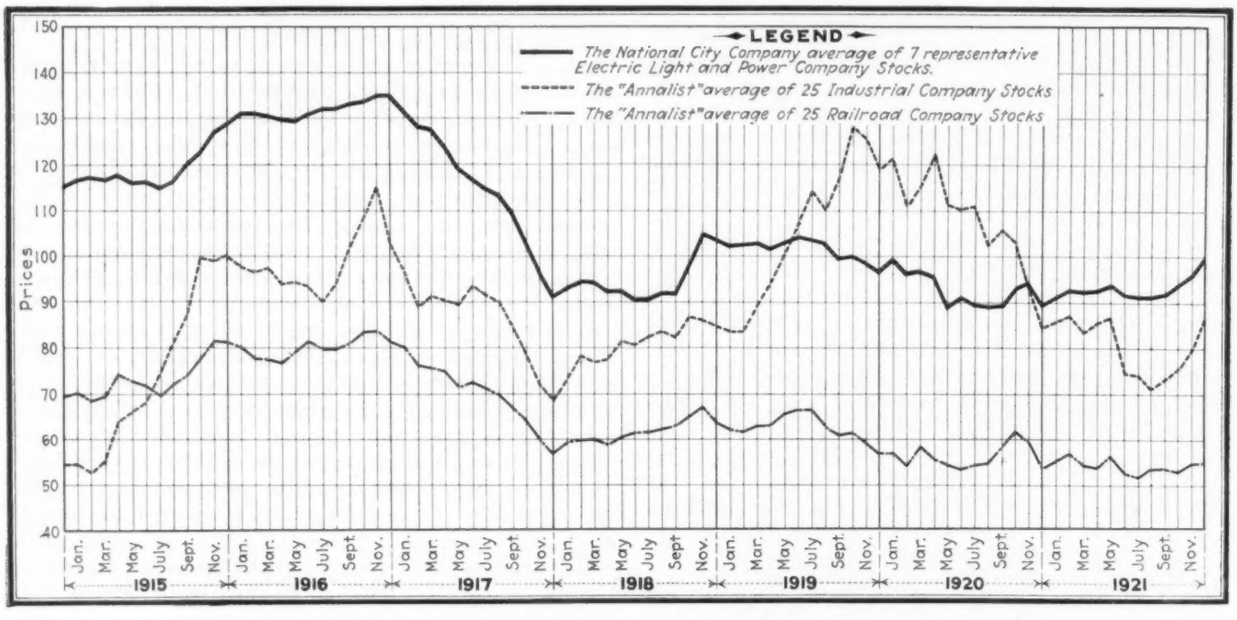
PERHAPS one of the most encouraging outcomes of the period of depression which gripped all industry during the first three-quarters of 1921 has been the enviable position attained in the financial world by the stocks of electric light and power companies. Careful investors are seeking securities the value of which will not be materially affected by existing industrial conditions, and it would appear that the stocks of electric light and power companies are meeting these rigid requirements. Our industrial and financial structure is so interwoven that absolute immunity from outside effects is impossible, but when an industry like that devoted to electric light and power supply becomes part and parcel of the national life its earnings, both gross and net, fluctuate little from year to year.

Moreover, the electric light and power industry is a growing industry, as is instanced by the acquirement of 1,001,700 new residential lighting customers during 1921 and an increase in the total gross revenue of $51,200,000 over that of 1920, which was itself a record year, while during the same period the total operating expenses decreased by $8,853,000. The investing public is beginning to sense these dividend-paying qualities exhibited by electric light and power companies' stocks. Through the courtesy of the National City Company, the ELECTRICAL WORLD is able to continue through December its chart* showing the average prices of the common stocks of seven representative light and power companies, twenty-five industrial stocks and an equal number of railroad stocks.

So far as is possible, the electric light and power stocks represented in the curves are of companies having a purely electric light and power business. With one exception, companies combining more than one utility have not been included in the tabulation. In order that the curves may be comparable the values plotted have been obtained by averaging the high and low.

There has been a marked tendency toward stability in the market price of electric light and power stocks during the past year as against a very appreciable fluctuation in the case of stocks of industrial corporations and rails. The accompanying tabulation of price of stocks brings out very clearly this comparative stability. The fluctuations in the prices of bonds of companies in the industries represented, while much less pronounced, would show approximately the same relative proportions as do the junior securities.

It will be observed that the total fluctuation of the electric light and power stocks based on the percentage of the range to the low during the past seven years has been but one-third that of the industrials, and considerably less than that of the seasoned rails. This relation holds substantially true not only over a long period but for the past year of reactionary market tendencies as well. The stability of the electric light and power stocks is a reflection not only of their relative immunity from temperamental labor markets (statistics show that the labor item amounts to but 18 per cent of the gross revenues of the electric light and power companies as compared with 52 per cent in the case of the railways), but, as indicated above, from the rise and fall of the cycle of business prosperity as well.




SEVEN-YEAR FLUCTUATION OF LIGHT AND POWER STOCKS ONE-THIRD THAT OF INDUSTRIALS

| | 1915 to 1921 Inclusive | | | | Year 1921 | | | |
|---|---|---|---|---|---|---|---|---|
| Stocks | High | Low | Range | Per Cent of Low | High | Low | Range | Per Cent of Low |
| Industrials.. | 127.96 | 52.57 | 75.39 | 143.3 | 86.47 | 71.49 | 14.98 | 20.9 |
| Rails..... | 83.60 | 52.31 | 31.29 | 59.9 | 56.80 | 51.50 | 7.30 | 14.2 |
| Electric light and power.... | 134.81 | 88.71 | 46.10 | 52.0 | 99.55 | 90.18 | 9.37 | 10.4 |

The fact that the prices of electric light and power stocks increased during the later part of 1921 was due in large part to the principle that since the earnings of utilities companies warrant virtually a fixed return on their stock, these stocks will follow inversely the market price of money.

*See ELECTRICAL WORLD, July 23 and Oct 8, 1921.

# Letters from Our Readers

This is a readers' forum. Comments on questions before the electrical industry presenting economic, financial, engineering or commercial aspects and new or supplementary viewpoints on published articles are cordially invited

## Time Switch Compensates for Varying Time of Dusk

*To the Editors of the* ELECTRICAL WORLD:

Permit us, as factory representatives of the time switch mentioned in the article on "Achievements in Electrical Equipment" in your issue for Jan. 7 (page 17), to draw your attention to two statements which, if left uncorrected, will give your readers an erroneous impression. The small motor used in this switch is of the universal type, series-wound, and can be operated on 110/125-volt or 220/150-volt alternating current or direct current. The automatic adjustment is to compensate for the changing length of the nights, not months. It is accomplished with the patent "astronomic" dial, which closes and opens the circuit in accordance with the varying time of dusk and dawn throughout the year, thus eliminating adjustment by hand.

We appreciate the recognition you have given this time switch in your valuable article, but in justice to the product in question, and particularly on account of the identifying illustration accompanying said article, we should appreciate a correction, if possible.

R. W. Cramer Company, R. W. CRAMER.
New York City.

## Carrier Current for Interstation Communication

*To the Editors of the* ELECTRICAL WORLD:

On page 1,189 of the ELECTRICAL WORLD issued Dec. 10, 1921, I note an article entitled "Carrier Current for Interstation Communication Demonstrated." In this article it is stated that effective communication between generating station and distribution centers by the carrier-current system over power lines was demonstrated for the first time by the General Electric Company.

I beg to call your attention to an article in the ELECTRICAL WORLD of July 17, 1920, page 141, which article was an account of a demonstration of carrier-current communication over power wires of 22,000 volts between Atlantic City and Ocean City, N. J. This demonstration was very successful. In May, 1921, we obtained results by means of the same system in talking over a transmission line operated at 132,000 volts between Canton, Ohio, and Wheeling, W. Va., a distance of about 55 miles. The circuit at that time was delivering 25,000 kw. of energy. In this system the carrier-current frequency was obtained by means of oscillator tubes, and a connection to the high-tension line was made by means of current transformers. The experiment was repeated with the connection to the line made on the low-tension side of the power transformer by means of current transformers. In other words, we succeeded in talking through the power transformers. With the large amount of energy transmitted at the time of talking, there was virtually no 60-cycle noise in evidence.

I am merely calling to your attention the misstatement of the fact contained in your specific assertion that carrier-current communication over power wires was first demonstrated on Dec. 7, 1921, while we had successfully demonstrated it in June, 1920.

M. L. SINDEBAND.
American Gas & Electric Company,
New York.

[Mr. Sindeband is quite correct in his statement, but the American Gas & Electric Company's demonstration, as the published statement shows, was before officials of that organization. In that sense it was not a public demonstration. The significance of the recent statement in the ELECTRICAL WORLD was that the General Electric Company had developed its equipment to the point where it was willing to demonstrate it before a representative group of the electric light and power industry.—EDITORS.]

## Electrical Ore-Locating Device Developed in Arizona

*To the Editors of the* ELECTRICAL WORLD:

We have had a great many inquiries relative to the ore-locating device developed by the Arizona Bureau of Mines, and the thought occurred to us that perhaps a number of your readers would be interested to learn of the present status of the work. I wish to say that we have been conducting experiments with it for over a year and now feel convinced that it is practicable. Our work has been almost entirely confined, however, to copper ores, but we are satisfied that it will operate equally well on pyritic gold ores. We expect to continue our experiments for several months more and hope to have an opportunity to ascertain whether the device can or cannot be used to locate deposits of other metals.

No description of the process or apparatus will be issued until it is known that our application for patent has been received and filed in the Patent Office at Washington. Neither will any attempt be made to use the apparatus commercially until more information concerning its possibilities and limitations has been secured. It is possible that one or more companies will be formed next summer to use the process commercially. The university will never use the process for the benefit of individuals and may make no attempt to benefit financially in any way from the invention. It will, however, probably retain sufficient control over the device to prevent its ever being used by incompetent or dishonest people.

The process is not applicable, so far as is now known, to the location of oxidized ores, nor can it at present be used where there are numerous metallic connections between the surface and underground sulphide-ore bodies.

The apparatus used is comparatively expensive and delicate, and a high degree of technical skill is necessary to utilize it satisfactorily. For these reasons it is presumed that mining companies will employ men trained in the use of the method rather than attempt to use it themselves. The expense of the work may then easily run up into thousands of dollars, but under suitable conditions may readily result in the saving of vast sums of money and the more complete development of our mineral resources.

G. M. BUTLER,
Dean and Director.
University of Arizona,
Tucson, Ariz.

## Transmission of Radio Signals Beyond the Earth's Atmosphere

*To the Editors of the* ELECTRICAL WORLD:

I have read the letter of Charles Rettie published in your issue of Jan. 14 with great interest, particularly because of the suggestion that it may be impossible to transmit radio signals beyond the atmosphere of the earth because of the electrical conductivity of an upper layer. It does not appear to me that the mere fact of conductivity precludes the possibility of the passage of electrical disturbances through or beyond this layer. In the first place, this layer is probably not uniform and therefore its conductivity may vary from place to place. In addition to this, it seems quite possible that local regions of high electric intensity as between the earth's surface and the upper conducting layer taking place over very short intervals of time may well cause oscillations of charges in the non-uniform conducting region of the upper layers. In this way it would appear quite possible to obtain potential gradients beyond the region of high conductivity.

There is one natural phenomenon which suggests that it may be possible to penetrate the upper conducting layer, namely, the magnetic storms on the surface of the earth. It is supposed that these storms have their origin in phenomena on the sun. It is well known, for example, that a period of great sun-spot activity is usually accompanied by magnetic storms on the surface of the earth. It is suggested that the sun emits streams of negative electrons and that the absorption of these electrons in the upper layers of the atmosphere causes not only variations in conductivity, but also the emission of electromagnetic waves which penetrate into the earth's atmosphere, causing such phenomena as magnetic storms, the aurora borealis, and possibly other types of meteorological disturbances.

It appears to me therefore a somewhat extreme claim that owing to the conductivity of the upper layers it is impossible for electromagnetic disturbances to pass through them.

J. B. WHITEHEAD.
Johns Hopkins University,
Baltimore, Md.

## Changes Necessary in Pole Specifications

*To the Editors of the* ELECTRICAL WORLD:

As pointed out by you on page 1310 of the Dec. 31, 1921, issue of the ELECTRICAL WORLD, several agencies are at work at present proposing changes in pole specifications in an attempt to unify the present specifications and to make similar specifications for all kinds of timber. In my opinion there are two important reasons for this state of affairs. One is our knowledge that there is a noticeable decrease in the supply of timber that meets with the present specifications. This naturally means that poles bought under these specifications are increasing in price, with the evident result that the buyer is trying to determine the cause of this increase. The producer also realizes that he soon will be unable to furnish poles bought under present specifications, and his hope is to make better use of the timber that nature is growing.

The second important reason is the more general realization that what is wanted in poles is a given strength at the most reasonable price. This realization is in part due to the rise of price of poles and in part to an advance in engineering knowledge. The actual stresses on poles in operation are better understood than they were. The necessity for specifications resulting in the purchase of poles of uniform strength is becoming more apparent. The fundamental principle that the weak section of a pole should be taken at the ground line is better understood. The fact that decay lowers the weak section from some point above the ground on a new pole to the ground line on a pole that has been in service some time has become well known. The effect of the top diameter in the matter of strength is understood, and it is appreciated now that all that is necessary, except in case of special guying, is a section at the top large enough for framing. The conclusion can therefore be drawn that better knowledge of stresses on poles and the desire for economy are going to result in better use being made of our timber. There is little question that specifications will be drawn in the near future that will be satisfactory both from the conservation standpoint and the structural standpoint.

Detroit Edison Company, P. O. REYNEAU,
Detroit, Mich. Assistant Electrical Engineer.

## Saving from Increased Feeder Capacity

*To the Editors of the* ELECTRICAL WORLD:

Often in direct-current installations where a mixed load of motors—say mining machines, locomotives and pumps—is operated from the same feeder line, it is desirable to demonstrate the saving in watts which will result from increased feeder capacity. Such a load, of course, registers a certain value in amperes on the switchboard at the power house or substation. By Ohm's law, since we know the resistance of the present feeder in ohms and the current it carries in amperes, we can determine the drop in volts and from it the operating voltage at the point of load. The input watts of the machinery in question will then be the product of this voltage times the amperes. To ascertain the saving from putting additional copper into car lines, we must first determine the decreased current values which will flow due to the lessened resistance.

If we use the formula $I^2R - EI = -W$, in which $R$ = resistance in ohms of feed line with added capacity, $E$ = voltage at generator, and $W$ = input watts of load derived from former values for volts and amperes at point of load, then $E \times$ (old value of $I$) $- E \times$ (new value of $I$) = saving in watts brought about by increasing feeder capacity.

This, of course, will not be entirely accurate since increased motor efficiencies will give slightly reduced outputs. Thus, in order to get the same output from our motors as formerly, our new value of $I$ will be slightly greater than it appears from the equation and our saving in watts slightly less. However, the results obtained are sufficiently accurate for most practical purposes.

In applying a single motor at the end of a transmission line, or in calculating saving from increasing the size of the transmission line in such an installation, if the formula is written as follows quite accurate indications of expected results will be obtained: $I^2(R + R_1) - EI = -W$, in which $W$ = load in watts of motor (hp. $\times$ 746), $R$ = line resistance, $R_1$ = resistance of armature circuit of motor, and $E$ = generator voltage.

The writer has found both applications of this equation quite useful.

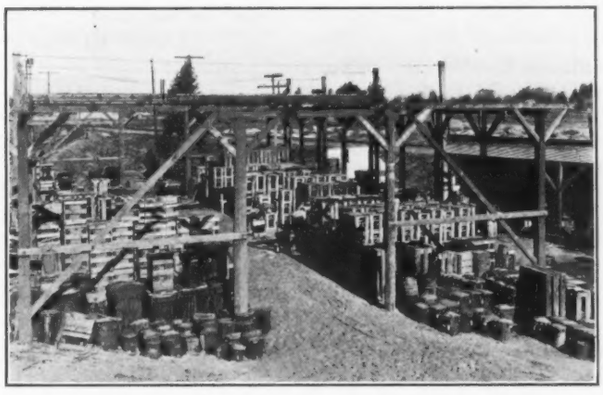
E. D. KNIGHT,
Chief Electrician.
Cabin Creek Consolidated Coal Company,
Kayford, W. Va.

# Industrial and Station Practice

Installation, Operation and Maintenance of
Generating and Distribution Equipment and Economical Utilization of Electrical Energy
in Mills and Factories, Including Testing and Repair Methods

## Distribution Transformers Stored Outdoors

A CONSIDERABLE saving in the cost of warehousing and handling a large order of distribution transformers was effected by the San Joaquin Light & Power Corporation of Fresno, Cal., through the storage of these transformers in a yard, as shown in the accompanying photograph. A hand-operated crane was erected overhead on a wooden structure at a very low price, and



SHOWING EIGHT THOUSAND TRANSFORMERS STORED OUTDOORS

the transformers were hauled into the storage yard on trucks, unloaded and stacked by the use of the crane. In a similar way when removing transformers they were placed on a truck with the greatest ease. In the San Joaquin Valley the climate is comparatively dry, and as the transformers did not remain outdoors very long no great risk was run of damaging them by moisture.

San Joaquin Light & Power Corp., E. P. SMITH.
Fresno, Cal.

## Single Conductors in Iron Pipe Found Objectionable

SOME time ago the writer had occasion to investigate certain damage upon outgoing feeders from a substation. The damage was caused through a severe lightning storm striking the aërial lines. The feeders were single-conductor, lead-covered and paper-insulated, and ran up the wall of the station in iron pipes connecting with the overhead lines on the roof. These feeders running in the iron pipes were connected with an automatic voltage regulator in the station, and for lightning protection a set of choke coils was connected in the overhead lines together with an electrolytic aluminum lightning arrester. The lightning upon striking the lines passed the choke coils and broke down the insulation on all the cables entering the pipes. According to my observations, this was caused by the inductance of the pipes piling up a high induced voltage on the end of the cables.

When a single conductor in an iron pipe carries an alternating current the amount of flux interlinking the conductor throughout the pipe length is greatly increased on account of the high permeability of the iron, and as the conductor is carrying an alternating current the rapid reversal of the flux produces hysteresis and eddy-current losses which are dissipated in the iron as heat. The temperature may become so high as greatly to increase the fire hazard. For this reason it is not safe practice to run single alternating-current conductors through iron pipes. The inductance set up by having the cable surrounded by iron produces a steep wave front or high-frequency surge and increases the likelihood of insulation failure especially where the cables enter the conduits. R. H. N. LOCKYER.
Trail, B. C.

## Erector's Instructions for Installing Engine-Type Generators

PLANT engineers who have not had experience in erecting engine-type generators may find some value in the following directions, which are intended to cover the problems usually arising in installing such equipment. The instructions apply to moderate size engine-driven machines of either alternating-current or direct-current design in which the rotor has been forced on the shaft at the factory. It is assumed that the engine bed has been set and that no crane is available.

Run a line through the center of the bearings and with a straight edge laid across the generator foundation measure from the bottom of the straight edge to the line to see if sufficient space is available for the generator. Next, measure from the center of the armature core to one crank disk and drop a light plumb line down into the generator pit from the line through the bearings to check the position of the foundation bolts. Measure in all directions, this plumb line to hang at a point corresponding to center of armature core as measured from the disk.

After placing cap plates on foundation bolts with a wedge under each corner, put the bottom half of field frame over pit, skids and all. To remove skids, rig a gin pole or A-frame for lifting frame. Lift one end, cut skids and remove the lifted end. Replace skids by substantial blocking so weight rests on cap plate. Do the same at other end. Then by raising one end and putting in lower blocking let that end down 2 in. or 3 in. Repeat on other end and continue till all blocking is cut and bottom half rests on cap plates. An A-frame like a big sawhorse with a chain block over each plate will handle this job quickly and well. If the chain hoists and A-frame are strong enough to trust, the bottom half can be lifted clear of skids, the skids removed and the piece lowered onto plates without blocking; but it is always wise to keep enough blocking under the feet so that if anything breaks, the piece cannot fall more than 2 in. or 3 in. Having landed the bottom half on the cap plates, move it over so that the foot bolts can be inserted. Then start the bolts in the threads and shift the frame so that the bolts stand centrally in the holes, finally screwing down tight with no shims under the feet.

With the slush cleaned off the bearing portions of the armature shaft block up the ends high enough for the crank disk to clear the engine bed. By careful blocking and lifting

shift the rotor over until the shaft rests in the bearings and lower it. With the assistance of the engine man check the shaft to see that it is level. Then wedge up under the cap plates until the bottom half clears the armature.

The top half of the field frame should then be placed over the bottom half, lowered and the frame bolts inserted and drawn tight. The field frame and cap plates can then be shifted as one piece until the poles line up with the core all the way around. This can be best done by putting three wedges under each cap plate, locating a wedge at the middle of each end and at the middle of one long side. By driving in or pulling out these wedges the whole piece can be lifted or lowered a little, and by driving in the wedge at one end of each cap plate and pulling out on the other end the frame can be rocked on the middle wedge so that it will stand plumb and the poles will line up with core all the way around.

At the same time see that the air gap on each side is equal and that the air gap at top is about $\frac{1}{16}$ in. (1.5 mm.) greater than at bottom. Lay a long straight edge across pit on the cap plates and place a level on it to be sure that the cap plates are approximately the same height. The purpose is to fit everything to the armature and shaft.

Carefully, and without disturbing the adjustments, drive a wedge under each corner of each cap plate, close to the foundation bolt. Drive just enough to set firmly and draw down tight on the bolts. Take out all the wedges except those at the corners, except in the case of very long plates or very heavy machine, when the middle wedge on the long side should be left in. Check all adjustments once more and "grout in" the cap plates.

Grouting is usually part of the foundation man's job and should be done as follows: Build a dam around each cap plate, as high as the top surface. Make the dam of mud, bricks, boards or any convenient material. Mix Portland cement and water to form a thin paste, like thick paint. Pour into grouting holes in plates until spaces under plates are full. Allow it to set two days, remove dams, and trim off excess cement around outside. The wedges can be left in place if they are not unsightly. Engine men usually take out their wedges, but they have reasons which do not apply to generator work.

After grout has set, if it is a split-frame alternator, remove the foot bolts, clean off the cap plates, side-shift the stator and put in joint coils and bridges, and connect the winding. Then shift the stator back to place. Raise the lifting screws and put in sheet-iron shims under each foot to make the air gap correct at top and bottom. It is advisable to leave it a little less, not more than 0.006 in. (0.4 mm.) less on top than bottom. The unbalanced magnetic pull thus created relieves the bearings of some of the armature weight. If too much out of center, a direct-current armature without balancing windings will have unbalanced currents and brushes may spark. The reason for setting a frame so that it is just comfortably clear of the armature when all shims are out is to allow all shims to be removed and still have clearance enough to side-shift the frame. It is difficult to shift a frame with shims under the feet, and it is difficult and bad practice to shift a frame while standing on the lifting screws. After the grout has set and shims are in make sure that the foundation nuts and foot bolts are tight. Then put on small fittings such as brush rig, shields and terminals.

If the machine has a pit plate, set it on the floor or over the pit with a wedge under each corner. Along each edge place two pieces of strap iron, about as thick as the amount of shims under each frame foot. On top of these pieces of strap iron lay three or four sheet-iron shims (full size) of pit plate. Then drive in wedges with a heavy hammer until the pit plate and its shims sit firm under the pad on the bottom of frame, and grout the pit plate.

Go over every bolt and nut to see that they are tight, clean up machine and adjust and sand the brushes ready to start up. If it will be some time before the machine is started provide a covering to keep it clean and dry. Apply grease or vaseline to all bright iron or steel parts so they will not rust. If the machine is left without starting it, leave it with brushes raised and the field circuit open at the machine so the engine man can run and tune up his engine without running up voltage on the machine.

JAMES DIXON.
Reliance Electric & Engineering Company,
Cleveland, Ohio.

## Unit Costs for Estimating Line Extensions

TO REDUCE the cost of estimating pole-line extensions the accompanying table has been computed. The various items have been separated so that the cost of labor and material may be readily obtained for any portion of an extension on either existing poles or new poles, and the same classifications permit the separations of an estimate into the respective accounts to which the work is chargeable.

COST IN DOLLARS FOR EXTENSIONS TO DISTRIBUTION

| Description | Spans | | | | | | | | | | Average per span for more than five spans. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | | 2 | | 3 | | 4 | | 5 | | | |
| Poles and fixtures: | Material | Labor | Material | Labor | Material | Labor | Material | Labor | Material | Labor | Material | Labor |
| 30 ft. | 27.63 | 13.18 | 49.67 | 19.26 | 69.62 | 25.34 | 89.75 | 31.40 | 109.71 | 37.50 | 20.95 | 6.79 |
| 35 ft. | 31.28 | 13.36 | 56.77 | 19.62 | 80.42 | 25.88 | 104.25 | 32.12 | 127.41 | 38.40 | 24.60 | 6.97 |
| 40 ft. | 34.30 | 13.96 | 62.97 | 20.80 | 89.62 | 27.70 | 116.45 | 34.50 | 142.91 | 41.40 | 27.62 | 7.57 |
| 45 ft. | 42.64 | 14.70 | 79.65 | 22.30 | 114.62 | 29.90 | 149.95 | 37.50 | 184.51 | 45.10 | 35.96 | 8.31 |
| 50 ft. | 49.02 | 16.29 | 92.41 | 25.50 | 134.12 | 34.65 | 174.85 | 43.80 | 216.41 | 53.00 | 42.34 | 9.90 |
| 55 ft. | 57.81 | 16.92 | 110.00 | 26.74 | 160.15 | 36.56 | 210.49 | 46.25 | 260.46 | 56.20 | 51.13 | 10.53 |
| 60 ft. | 64.82 | 19.93 | 124.01 | 32.76 | 181.18 | 45.59 | 238.53 | 58.50 | 295.51 | 71.30 | 58.14 | 13.54 |
| Six pin arms | 9.80 | 5.80 | 13.97 | 7.30 | 16.12 | 8.80 | 18.45 | 10.30 | 20.41 | 11.80 | 3.12 | 1.90 |
| Wire, secondary: | | | | | | | | | | | | |
| Two No. 6 | 5.35 | 6.10 | 10.13 | 8.60 | 14.72 | 11.10 | 19.40 | 13.60 | 24.22 | 16.10 | 4.78 | 2.86 |
| Three No. 6 | 7.85 | 7.35 | 15.00 | 11.10 | 22.23 | 14.85 | 29.38 | 18.60 | 36.23 | 22.35 | 7.22 | 4.11 |
| Two No. 4 | | | | | | | | | | | | |
| One No. 6 | 9.85 | 7.35 | 19.10 | 11.10 | 28.43 | 14.85 | 37.58 | 18.60 | 46.93 | 22.35 | 9.32 | 4.11 |
| Three No. 4 | 10.95 | 7.35 | 21.20 | 11.10 | 31.43 | 14.85 | 41.68 | 18.60 | 51.93 | 22.35 | 10.32 | 4.11 |
| Three No. 2 | 17.75 | 8.60 | 34.30 | 13.60 | 51.05 | 18.60 | 67.48 | 23.60 | 84.00 | 28.60 | 16.76 | 5.36 |
| Three No. 2/0 | 34.05 | 9.20 | 67.10 | 14.80 | 99.65 | 20.40 | 132.98 | 25.60 | 165.83 | 31.10 | 33.05 | 5.86 |
| Wire, primary: | | | | | | | | | | | | |
| Two No. 6 | 6.09 | 6.10 | 11.36 | 8.60 | 16.48 | 11.10 | 21.60 | 13.60 | 26.92 | 16.10 | 5.29 | 2.86 |
| Four No. 6 | 12.18 | 8.60 | 22.72 | 13.60 | 32.96 | 18.60 | 43.20 | 23.60 | 53.84 | 28.60 | 10.58 | 5.36 |
| Four No. 4 | 16.08 | 8.60 | 30.72 | 13.60 | 45.26 | 18.60 | 60.00 | 23.60 | 74.64 | 28.60 | 14.74 | 5.36 |
| Four No. 2 | 26.90 | 9.85 | 50.14 | 15.10 | 73.08 | 22.35 | 96.52 | 28.60 | 119.36 | 34.85 | 23.47 | 6.61 |
| Four No. 2/0 | 49.20 | 11.10 | 93.64 | 18.60 | 138.08 | 26.10 | 183.52 | 33.60 | 227.96 | 41.10 | 45.27 | 7.86 |

These figures are based on copper at 15½ cents, poles at 1921 average price, spans of 125 ft., supervision 7 per cent, injuries to labor 6.6 per cent, and line material, costs of Dec. 1, 1921.

The table is computed for triple-braid weatherproof copper wire at 15½ cents per pound, butt-treated Western cedar, N.E.L.A. class B poles, line hardware and cross-arms at market price, and for average spans of 125 ft. To the actual cost of material and labor have been added 7 per cent for engineering and supervision and an additional 6.6 per cent to the labor cost for injuries and accidents.

D. C. HOPPER,
Distribution Engineer.
Northern Ohio Traction & Light Company,
Akron, Ohio.

## Experience with Carbon-Tetrachloride Fire Extinguishers

HOWEVER great the efforts made to prevent fire in power houses may be, a breakdown of insulation may occur, and for this reason an operator must always be prepared to combat flames. He must know the location of each piece of fire-fighting equipment, the method of its use and its limitations. The stations of the Consumers' Power Companies are supplied with one or more of three classes of fire-fighting apparatus, the carbon-tetrachloride and soda-acid extinguishers and the regular fire hose.

The carbon-tetrachloride extinguisher is the "first line of defense." This type of extinguisher is furnished in 1-quart and 1½-quart sizes under different trade names. Carbon-tetrachloride liquid, under various designations, is used as the fire-extinguishing agent. This evaporates rapidly, especially in the presence of heat, and forms over and around the fire a "blanket" of non-conducting gas that will not support combustion, smothering the flames very quickly. The liquid gas is an excellent insulator, having several times the dielectric strength of air. In addition to this valuable property it does not injure any fabric or other substance with which it comes in contact. A further valuable characteristic is that it will not freeze. The non-conducting properties of this liquid and the gas formed from it make it safe to use around apparatus and conductors energized at any voltage, if the extinguisher is not permitted to touch or approach the energized conductor.

In extinguishing an arc the stream of carbon-tetrachloride should be directed at the point where the arc originates. In any fire the stream should be directed at the base of the fire. If oil is burning in a transformer case or other partly closed receptacle, the stream should be directed *across* the surface of the oil, rather than down into it. In the latter case the heavy liquid will settle at once to the bottom of the oil tank, without doing any good. The carbon-tetrachloride extinguisher is the only kind with which this company is equipped that is safe to use on energized conductors. No other extinguisher should be used until not only the broken-down unit but all other energized apparatus in its vicinity has been taken off the line and made dead, and in the case of the high-tension circuits grounded.

While carbon-tetrachloride will extinguish an arc, it will not prevent it from forming again, if the arcing points are so close together that the voltage will jump the gap. If this occurs, and if it be impossible for any reason to get the apparatus off the line, the arc may be held down by repeatedly spraying the arcing points with the liquid, thus keeping it covered with a gas blanket.

It must be remembered that any breakdown of insulation that is serious enough to start a fire calls afterward for a careful examination at least, and in most cases for repairs, before the unit affected can be depended upon for safe and reliable service. Therefore, if any apparatus takes fire and it is possible to take it off the line, it should be made dead at once, as the fire can be handled much better in the dead machine and it will be necessary anyhow to have it dead before examination and repairs can be made.

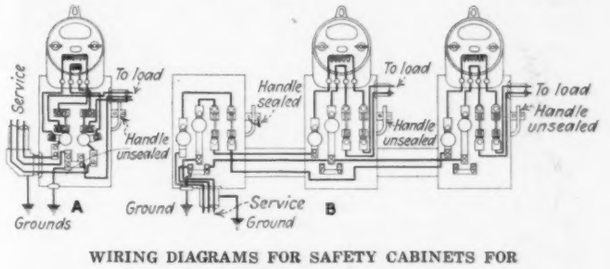
The tetrachloride extinguishers should be filled as soon as possible after use, so as to be ready for any further trouble that may develop and so that the refilling will not be forgotten. Enough liquid should be kept on hand to meet any reasonable need, and new supplies should be ordered before the old supply is exhausted.

In some stations carbon-tetrachloride extinguishers of large capacity are installed for fighting generator and other fires in places difficult of access. In these extinguishers pressure is maintained by means of an air compressor or hand pump. Frequent inspection must be made of these extinguishers to make sure they are maintained at or very near the required pressure so that they may be ready for instant use. When used, immediate steps should be taken to have them refilled to full capacity. In case they are partly discharged, the normal air pressure should be restored at once and the tank refilled as soon as possible.

Consumers' Power Company, H. J. BURTON.
Jackson, Mich.

## Safe Method of Mounting Supply Cut-outs and Meter Cabinets

THE specifications for mounting meter cut-out boxes and cabinets recently issued by the Edison Electric Illuminating Company of Boston are good examples of standard safe practice. These specifications are now written to comply with the new code requiring the customer's service pipe to extend to and enter the cut-out




WIRING DIAGRAMS FOR SAFETY CABINETS FOR SERVICE CUT-OUTS AND METERS

A—Combination safety cut-out cabinet and meter for single-phase. B—Safety cut-out cabinet and combination meter and safety switch cabinets for two or more meter installations.

cabinet. Up to 100 amp. the company requires the service cabinet to be of a special improved design, permitting the mounting of a watt-hour meter in combination with the cabinet, adapter end walls permitting the use of any of the standard types of meters. In sizes above 100 amp. the combination of the meter with the service cut-out cabinet is not required, the standard National Electrical Code fuses and switches mounted in a sealable metal cabinet being acceptable. Where the meter is not combined with the service cut-out, a separate cabinet with meter cut-out is required for each meter called for in the installation.

Five approved types of cut-outs and cabinets are available to contractors in the Boston Edison territory (Johns-Manville, Trumbull, Metropolitan, Square D and Westinghouse), these equipments being practically interchangeable as to size and fittings. They are adapted to either direct-current or alternating-current (single-phase) service, 115-volt, two-wire, or 230-volt, three-wire connection, thus minimizing the stock to be carried and the changes required in case of additional installation at a later date. In all sizes provision is made for carrying the neutral wire into or through the cabinet without fuse or switch, but with a "disconnecting link" to conform to the National Electrical Code. A solder lug is provided at the neutral terminal for the

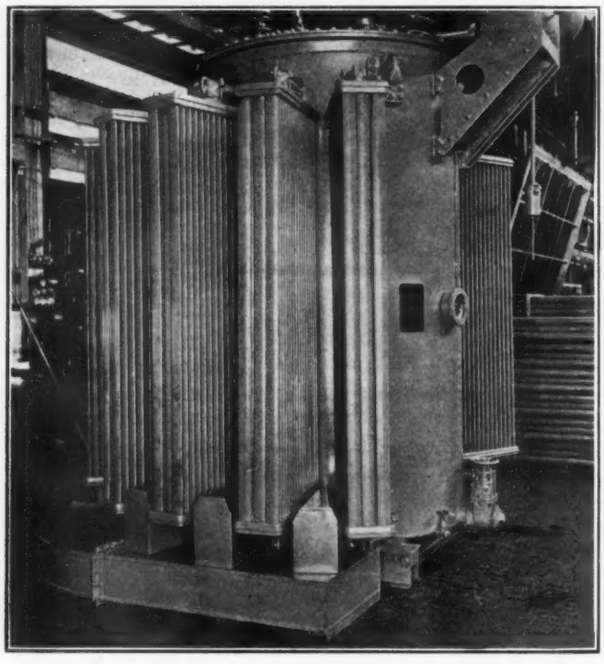
connecting of the ground wire to be brought into the cabinet through knock-outs in the bottom. To save time in making connections to meters integral with cut-out cabinets, the proper short lengths of cut and end-stripped wire are provided in each case. Standard connections are shown in the accompanying diagram.

This company has recently established a regulation placing upon the wiring contractor the responsibility for this construction and has given up the practice of furnishing switches and cabinets at its own expense. The company has for some time been one of the few that assumed this portion of the service investment.

Boston, Mass. FIELD EDITOR ELECTRICAL WORLD.

## Forced Ventilation of Transformers Increases Capacity 25 per Cent

WITH abnormally high air temperatures, such as exist in certain sections of southern California, it may be necessary to reduce the load on a self-cooled transformer below the transformer rating or to provide



AIR IS BLOWN FROM THE SHEET-IRON DUCTS TO COOL THE RADIATORS

some means of artificial cooling to keep the winding temperature within safe limits. The latter method has been adopted by the Southern California Edison Company for the 5,000-kva., 66,000/16,500-volt oil-immersed, self-cooled transformers shown in the illustration. The transformers as built by the Westinghouse Electric & Manufacturing Company were provided with air ducts surrounding the base, with openings between the radiators to direct the flow of air, which is furnished by a motor-driven blower. A hot-spot temperature indicator in the winding guides the operator properly in controlling the auxiliary system.

This auxiliary method of forced cooling has proved to be so effective that 25 per cent greater load can be carried with a given temperature rise in the transformer windings than is possible with natural air circulation.

FIELD EDITOR ELECTRICAL WORLD.

San Francisco, Cal.

## Testing Transformers in Service for Insulation Breakdown

FOR testing the condition of the insulation of transformers a high-potential test is probably the most reliable. Such a test may be made on a transformer installed in place provided it is disconnected from all lines.

If a transformer is to be tested on account of having been overloaded or overheated, or insulation breaking down on account of excess moisture in the coils, it has been found best to megger between windings and between windings and core before applying a high-potential voltage. If the transformer shows a low megger reading, it should be dried out or repaired as the case might be, then meggered again, and, if no trouble is indicated, tested by applying a high voltage the value of which is indicated in the accompanying table. The time of application for each test should be one minute.

VOLTAGES FOR HIGH-POTENTIAL TESTS ON TRANSFORMERS

High-Voltage Winding to Low-Voltage Winding and Core:

| Highest Operating Voltage | Test Voltage |
|---|---|
| Below 550 | 4,000 |
| 550 to 4,500 (inclusive) | 10,000 |
| Above 4,500 | Twice the highest operating voltage plus 1,000 volts |

Low-Voltage Winding to Core:

| Highest Operating Voltage | Test Voltage |
|---|---|
| 1,500 and below | 4,000 |
| Above 1,500 to 4,500 | 10,000 |
| Above 4,500 | Twice the highest operating voltage of the low-voltage winding plus 1,000 volts |

(Voltage should be applied for one minute)

The method of testing transformers with high potential has been developed to such an extent that a test transformer with a high range of voltage, of a portable type which can be easily moved from place to place, is now manufactured. It is a current opinion that no better method has been developed than the megger for indicating trouble, but as an indicator only. The megger will show a high resistance at times that a potential test will break. The high-potential method, however, can be recommended as a satisfactory way of making a test of transformer insulation.

This information was presented in the report of the committee on overhead and underground systems before the Southwestern Electrical and Gas Association.

Chicago, Ill. FIELD EDITOR ELECTRICAL WORLD.

## Unconventional but Effective

WHEN an emergency arises that requires equipment which cannot be obtained from a manufacturer for several days or weeks, the unconventional thing must sometimes be done, namely, to adapt existing equipment to the needs. In the case in mind an unanticipated load of indefinite duration was thrown on some oil switches which were threatening to overheat so badly that trouble was expected. In the absence of other relief some galvanized tanks several inches larger than the switch tanks were quickly constructed and tapped at the bottom and top of opposite sides for cold water inlet and outlet respectively. The tanks were supported so that they would inclose the switch tanks and water turned on. The makeshift performed its function satisfactorily until larger oil switches arrived about two months later.

Ancon, Canal Zone. MANUEL RODRIGUEZ.

# Management and Policy

Embracing Central Station Commercial Organization and Management, Customer and Trade Relationships, Public and Financial Policies, Advertising, Selling and Service Methods

## Financial, Engineering and Commercial Aspects of Interconnection

By Samuel C. Moore
General Manager New England Power Company, Worcester, Mass.

THE economic advisability of interconnection is no longer a debatable point, but if the best possible results are to be obtained, the engineering and financial aspects must have careful study. Each specific case of interconnection must be considered on its own merits. Broadly speaking, however, contractual relations should be flexible. This is essential so that a working arrangement can be developed along the most economical lines.

While it is desirable to make such interconnections on a basis both physical and financial that will permit of the most economic operation, it is equally true that "half a loaf is better than no bread," and inadequate interconnections will invariably demonstrate the wisdom of a more adequate arrangement and lead to it.

The tying together of large systems has raised many problems which have been only partly solved. Possibly the oil-switch problem is one of the most pressing. The service demanded of high-tension oil switches becomes more exacting as additional capacity is placed behind them. A proper system of relaying is an ever-present problem, and here probably more than in any other phase of interconnection eternal vigilance in studying the records of the relay performances and a proper knowledge in interpreting and correcting the faulty operation are necessary. A close follow-up on the relay situation will be amply repaid by the improvement and dependability of service.

The problem of maintaining satisfactory voltage is also one of considerable moment, and in order to keep ahead of this problem a continuous study and forecast of load conditions are imperative.

The problem of maintaining standard frequency when systems are tied together has presented some difficulties which are gradually disappearing. In order to insure a harmonious working together of interconnected systems, personal acquaintance between system operators is desirable. With this object in view the New England System Operators' Association has been formed. This association brings the men together in friendly intercourse, and as is invariably the case when men get to know each other a great deal of the friction which would otherwise take place is eliminated.

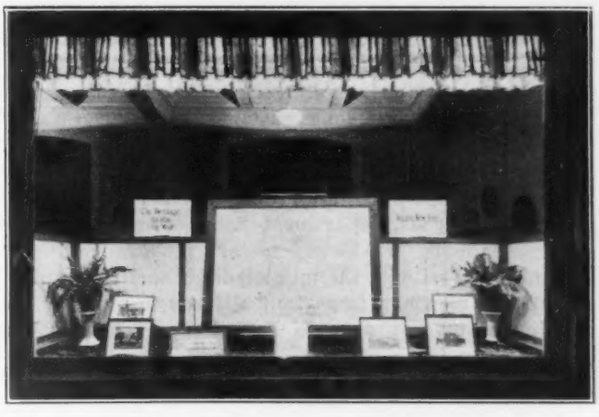
Condition of load and efficiency in handling it change so rapidly that constant study and analysis are necessary in reviewing results obtained from each inter-system connection. The excessive demands for power during the period of the war firmly established in the minds of every one connected with the industry the usefulness of interconnection. This was again made apparent during the protracted drought of last fall, and had the railroad strike materialized, threatening a fuel shortage in interior points, it would have aided in keeping industry and homes supplied with energy. In the great sleet storm of Nov. 27 and 28 last the numerous interconnections between systems not only facilitated handling service on lines which were still intact but aided in the restoration of service on lines that were in trouble.

The capacity of interconnections between the New England Power Company system and the systems of the Narragansett Electric Lighting Company, Blackstone Valley Gas & Electric Company, Fall River Electric Light Company, Edison Electric Illuminating Company of Boston, Worcester Electric Light Company, Eastern Connecticut Power Company, Turners Falls Power Company and several other smaller systems exceeds 150,000 kw. To operate these interconnections successfully experienced load dispatchers and extraordinary vigilance in the careful use of water power are essential.

In the final analysis economic interconnections are co-operative undertakings, and through their skillful co-ordination they benefit the public at large by the improved use they establish of facilities representing invested funds devoted to the supply of energy. Interconnection is a means whereby the waste of natural resources and labor can be reduced, and there can be no question of its continued value and further extension in the year 1922.

## Hartford Company's Facilities for Service Make New Year Window Display

THE Hartford (Conn.) Electric Light Company staged this interesting window display on New Year's Day by way of greeting to the local public. Photographs of the company's generating plants and transmission towers were "interconnected" by miniature pole lines and wires. The exhibit was backed by a large map of the State of Connecticut on which the company's retail and wholesale territories were indicated in red and green.



NEW YEAR'S WINDOW DISPLAY SHOWING EXTENT OF COMPANY'S SERVICE

## Store-Door Demonstration of Electric Signs

THE fall and winter months are the best time to go after the small electric sign business, and this illustration shows how an electric sign company is stimulating the sale and rental of signs in Chicago. The sign is securely mounted on the body of a runabout, and by means of a long cord it can be illuminated by plugging into a socket on the customer's premises. This method of actual store-door demonstration has helped materially in closing sales right on the spot.

Increasing interest in the use of electric signs has

AN EFFECTIVE ELECTRIC SIGN DEMONSTRATOR

been shown in Chicago this fall, with the result that the central-station company's income has also increased. This class of business is particularly desirable as the average income per kilowatt of station capacity is somewhat in excess of $100, which is about twice the average income per kilowatt of the entire station load.

## "Get Together" Meetings Gain Public Support for Utility

MEETINGS where the city officials and leading business men get together with the manager and employees of the local utility for a general discussion of the company's problems have been held by the Kentucky Utilities Company. "We have held a number of these meetings and found them very helpful," says L. B. Herrington, vice-president of the company at Louisville.

"Personal touch, friendly relations and wide acquaintance," he says, "go a long way in Kentucky to establish confidence and bring about correct understandings in business dealings. We therefore have local meetings and district meetings and gather together our local and district managers, department heads, company officials, superintendents, cashiers, meter readers and stock salesmen. We invite the municipal authorities, bankers, newspaper men and important citizens to our meetings and endeavor not only to sell the personnel of our organization to them but to interest them in our business problems and plans.

"Our organization is made up principally of Kentuckians and as far as possible recruits are drawn from the communities which we serve. We cannot afford to lose the co-operation of the local people. Our street-lighting and water-pumping contracts come up from year to year. We are drawing new capital from the sale of stock to our customers, and we are dependent upon the confidence and good will of our people. We must give them good service, tell them how hard we have to work to do it, let them know that we are as human as they are, that we are honest people in an honest business, convince them that the money we use in our business is the same kind that they earn and use in their business, take them in with us if they will come, and keep the thought away from them that there is some far-off, cold combination of capital seeking to take advantage of them.

"There is no commission in Kentucky, and our rates are fixed by the city councils. During the war we appealed to thirty different city councils for relief in the way of increased rates, curtailment of service and limiting capital expenditures for extensions and improvements. Assistance of some substantial character was secured in twenty out of the thirty cities. We have found that it helps to hold such meetings and to keep our case constantly before the public by newspaper and other advertisements."

## What Other Companies Are Doing

**Albany, Ore.**—Plans are being formulated by the Oregon Electrical Contractors' Association for opening a home electrical in this city at an early date.

**Newark, N. J.**—The electric iron campaign which the Public Service Electric Company conducted last fall in co-operation with the local contractor-dealers proved so successful that the company is planning to hold similar campaigns throughout the year 1922. In addition steps have already been taken to establish in the Newark papers a co-operative electrical page and the company hopes to have this under way by the latter part of January.

**Enid, Okla.**—The Enid division of the Oklahoma Gas & Electric Company has organized a club called the Enid Division Thrift Club. All the employees are members and the object is to save a certain amount each week, if it is nothing more than 50 cents. The company's preferred stock is bought every month and constitutes the assets. The club will close its books at the end of each year, and the members will be paid in the preferred stock of the company or cash, whichever they prefer.

**Ohio.**—The Northwestern Ohio Railway & Power Company of Toledo has closed a ten-year contract with the village of Elmore, Ohio, for supplying its municipal system with electric service. The village owns its own distribution and street lighting systems and furnishes all service used within the municipality. It is planned to electrify the municipal pumping plant and drive the present pumps with electric motors, this, in the past, having been done with gas engines. The contract was secured in accordance with the regular rates filed with the Public Utilities Commission of Ohio and will be subject to any changes which may be made in such rates during the term of the contract.

**Augusta, Me.**—The Central Maine Power Company has added about 4,600 hp. in connected load to its lines since Jan. 1, 1921. Activities on line extensions are being continued throughout the winter with unabated energy. A 5.5-mile extension is under way in the Poland district and one of 10.7 miles has been started in the Thomaston-Tenants Harbor district. The company looks forward to 1922 with enthusiasm, the diversified industries of the territory showing much improvement during the past few months. George S. Williams is general superintendent.

# Digest of Electrical Literature

**Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press of the World**

## Generators, Motors and Transformers

*Correcting Magnetic Side Pull in Rotating Electric Machines.*—A. M. DUDLEY.—Unless the rotating member of a machine is accurately centered and rigidly held, there is a tendency for the two members to approach one another and strike, with resulting damage to the machine. By proper connection of the windings, either on the stator or the rotor, it is possible to secure symmetry of the magnetic field and minimize any tendency toward this unbalanced side pull, with its resulting mechanical vibration, noise and likelihood of damage. Numerous diagrams are given to illustrate this method. —*Electric Journal*, January, 1922.

*Refilling Commutators.*—A. HERVEY.—A study of the insulation failure in commutators and a discussion of the assembly and baking of commutators.—*Power*, Jan. 10, 1922.

## Generation, Transmission and Distribution

*System of Locating Faults in Underground Cable.*—LUIGO SELMO.—The system described involves the use of two voltmeters, one in series with the capacity formed by the conductor and sheath and the other measuring the voltage applied across this condenser. Examples are given by the author of its application.—*L'Elettrotecnica*, Dec. 5, 1921.

*Power Generation in Steel Plants.*—D. M. PETTY.—Consideration of the operating conditions in steel plants, outlining means of increasing load factor and reducing the cost of power. Methods for utilizing waste gases are included. Power contracts which cover only the purchasing of power should be changed to cover interchange of power between steel plants and the power company, it is suggested.—*Paper read before the Philadelphia Section, A. I. and S. E. E.*

*Electrical Characteristics of Transmission Circuits.—XVII.*—WILLIAM NESBIT.—Continuation of a series of articles dealing with high-voltage transmission. In this article a typical 220-kv. problem is solved.—*Electrical Journal*, January, 1922.

*Effects of Sulphur in Fuel Oil.*—ALLEN F. BREWER.—The presence of sulphur in fuel oil is detrimental, but its deteriorating effect can be largely avoided by adopting proper precautions which are discussed in the article. —*Power*, Jan. 10, 1922.

*Behavior of Insulators Under the Effect of High-Frequency Voltages.* — FRITZ GRÜNEWALD. — High-frequency disturbances of high-voltage overhead lines are among the chief causes of insulator failures. There are two methods used for tests in the laboratory—the simple resonating circuit, resulting in a voltage shock test on the insulator, and the method of the coupled resonating circuit with the aid of a Tesla transformer. These two methods do not give the same results on the same insulator. The author claims that only the second test method, with the Tesla transformer, satisfies all requirements of a reliable insulator test and that it is at the same time simpler and less dangerous to the operator. A great number of test data are given to substantiate this claim. The testing method for insulators, as published by Creighton in the *Proceedings* of the A.I.E.E., May, 1915, is essentially the method indorsed by the writer.—*Elektrotechnische Zeitschrift*, Dec. 1, 1921.

## Lamps and Lighting

*Code of Lighting.*—The report of the committee on lighting legislation of the I. E. S. on the code of lighting for factories, mills and other industries has been issued to make available authoritative information for legislative bodies, factory boards, public service commissions and others interested in enactments, rules and regulations for better lighting. The text has been divided into three parts to facilitate reference. Part 1 contains rules arranged in convenient form for legal enactment or government regulations. Part 2 contains a discussion of the rules of Part 1; that is, it gives the legal requirements which must be met where a code is in force and also suggestions and general information as to desirable practice in factory lighting. Part 3 takes up the advantages of proper and adequate illumination, both natural and artificial, and discusses such lighting particularly from the standpoint of economics. The rules set forth in Part 1 cover (1) the illumination required in all kinds of business, (2) the diffusion and distribution of light and avoidance of glare, and (3) exit and emergency lighting. Part 2 gives various tables covering, for instance, approximate foot-candles in good lighting practice. Classification of light sources from the standpoint of glare is made, and some of the causes of glare are discussed, among which are (a) brightness of source, (b) total volume of light (that is, the light source may be too powerful for comfort), (c) location in the field of view, (d) contrast with background, and (e) time of exposure. Some of the advantages of good illumination are (a) reduction of accidents, (b) greater accuracy in workmanship, resulting in improved quality of goods, (c) increased production for the same labor cost, (d) less eye strain, (e) greater contentment of the workmen, (f) more order and neatness in the plant, and (g) the greater ease of supervision.—*Transactions I. E. S.*, Nov. 20, 1921.

## Traction

*Two New Types of Safety Cars for Chicago.*—CHARLES GORDON.—This article discusses the design and construction of single-truck and double-truck one-man safety cars that are arranged for double-end operation with separate entrance and exit passageways and a gate barrier in the exit. Diagrams, photographs and tables of general dimensions are given for both single-truck and double-truck types.—*Electric Railway Journal*, Jan. 14, 1922.

*Third-Rail Is Favored by Northwestern Pacific.*—Experience with third-rail support, methods of making

road crossing and feeder connections, protection of the third-rail, maintenance cost, bonding and effects of high water are discussed.—*Railway Electrical Engineer*, December, 1921.

*Selecting Designs for Electric Locomotives.*—A. W. GIBBS.—Abstract of a paper presented before the Franklin Institute giving results of a comparative trial of steam and electric locomotives made to get information for the design of locomotives for the Pennsylvania Terminal in New York City. Relative advantages and disadvantages of the quill and connecting-rod types are both considered. Methods of determining lateral impact are considered, and results of several tests are given.—*Railway Electrical Engineer*, December, 1921.

### Installations, Systems and Appliances

*Electric Telpher Installation at Plymouth Gas Works.*—H. BLYTH.—An interesting article on the handling of coke in the Plymouth gas works by means of a telpher or crane. A description is given of the electrical layout and overhead-suspension crane track.—*Electrician (London)*, Dec. 30, 1921.

*Reconstruction of French Winding Equipment.*—JOHN F. PERRY.—Reference is made to the difference between hoisting and lowering speed, a device for allowing this variation in speed, the duty cycles of hoisting equipment, operating costs and energy consumption for a specific installation. Three pages are devoted to a calculation sheet for electric winders, showing the factors which must be taken into consideration in selecting the equipment as well as the method of making the calculations.—*Beama*, December, 1921.

*New Control of Lowering Speed on Three-Phase Cranes.*—C. RITZ.—Instead of one three-phase lifting motor, two half-size motors, rigidly connected together, are used. Lifting is done with both motors in parallel, as if they were a single unit. In lowering a load, however, the two motors are energized in the opposite torque sense. On the first "down" step an equal amount of resistance is connected across both rotors, so calculated as to develop the full starting torque, which is about 50 per cent of the normal running torque. The motors will, therefore, balance each other without any motion if there is no load hanging on the hook. With a load the motor connected in the downward sense will start up and will reach a speed where the momentum of the load plus the torque of the downward motor is equal to the torque of the motor connected in the upward sense. Very small and accurate lowering speed may thus be obtained, which is virtually independent of the load. The two motors may be built very compactly as a twin motor in one casing. Characteristic operating curves of such a lifting motor are given.—*Siemens Zeitschrift*, December, 1921.

### Electrophysics and Magnetism

*An Investigation of Fatigue of Metals.*—H. F. MOORE and J. B. KOMMER.—A work of 185 pages, including forty-six illustrations, based on tests of materials well scattered over the field of ferrous metals, in which two or more distinct heat treatments for each metal are considered. A series of tests was conducted under reversed bending stress, using various stresses, until an endurance of 100,000,000 reversals was reached. In addition, corresponding static tests in tension, compression and shear were made, as well as hardness and impact tests. Magnetic analysis was employed for examining the homogeneity of the material tested and a study of various accelerated tests for resistance to repeated stress was made. The main purpose of the first stage of the investigation was to determine whether or not there exists, for ferrous metals, any clearly defined relation between static properties and ability to resist reversed sets.—*Bulletin No. 124, Engineering Experiment Station, University of Illinois.*

### Telegraphy, Telephony and Signals

*Operation of the Modulator Tube in Radio Telephone Sets.*—E. S. PURINGTON.—The most satisfactory method of modulating the output current of an electron-tube generating circuit is by variation of the operating plate voltage. A study is made of: (1) Operation of the modulator tube as an aperiodic power amplifier; (2) the actual load impedance of a tube acting as an amplifier; (3) imperfections of the audio choke coil due to its reactance; (4) the audio impedance of parts of the generating circuit, and (5) the presence of electromagnetic energy in the radiator unit. The signal strength under conditions of no distortion, using a receiving set with square law of reception, is proportional to the difference between the peak radio power and the minimum radio power in the transmitter radiator unit.—*Scientific Paper of the Bureau of Standards, No. 423.*

*Wave-Length Relations for Progressive Antenna Generation.*—A. PRESS.—It is shown (1) to what extent non-reflected progressive waves can be expected along wires fed from a source of sustained oscillations, (2) how progressive waves can be set up in the ether, and (3) how the antenna wave-length factor depends on the radiating efficiency of such antenna systems.—*Electrician (London)*, Dec. 9, 1921.

### Miscellaneous

*Recent Developments in Switzerland.*—STANLEY PARKER SMITH.—A comparison between locomotives produced by the Ateliers de Construction Oerlikon and the Baden Works of the Brown, Boveri Company, with a statement of the advance in design. The hydro-electric power station at Eglisau is described. It is rated at 42,000 hp. and has a head of 35 ft. (10.5 m.). The Ritom station at Piotta and the Amsteg station are also noticed. The Furka Railway, with the 14-mile (25.6-km.) Simplon tunnel, and the Loetschberg Railway are described.—*Electrician (London)*, Dec. 23, 1921.

*Hydro-Electric Report on St. Lawrence River.*—The Ontario Hydro-Electric Commission's report to the International Joint Commission. It is suggested that three alternative schemes for power development may be carried out, and the cost of each is given. An interesting study of the physical conditions is presented. The outstanding physical characteristic of the river from a water-power standpoint is the dependability and uniformity of its flow. The average discharge of the St. Lawrence during the sixty-year period of observation was about 247,000 cu.ft. per second. The total twenty-four-hour power which can be developed is in round numbers 4,000,000 hp., of which about 300,000 hp. is already developed. The capital cost per horsepower for the three schemes is approximately $95. With complete navigation improvements, this would be raised to the neighborhood of $125 per horsepower, and the same figure holds for 14-ft. navigation with the exception of one scheme which will cost $232 per horsepower with 14-ft. navigation.—*Canadian Engineer*, Nov. 24, 1921.

# News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

## Electric Utilities Repay 60 per Cent of War-Time Government Loans

OUTSTANDING loans to public utilities, as shown by the annual report of the War Finance Corporation, totaled $19,783,212.81 on Nov. 30, 1921. Advances outstanding on Nov. 30, 1920, totaled $21,132,995.52. Repayments during the year were $1,349,782.71. Under its war powers the corporation advanced $39,797,400 to public utilities. Of that amount $20,014,187.19 has been repaid. Of the foregoing amount the electric light and power companies borrowed $7,852,000. They have repaid $4,779,250.06, leaving outstanding on Nov. 30 last $3,072,749.84.

## Move to Place California Municipalities Under Regulation

UNDER the terms of an initiative measure which has been filed with the Secretary of State of California and which will appear on the general ballot in the November elections, municipally owned utilities are to be declared public utilities, and another similar measure will compel these utilities to pay taxes as do the privately owned utilities in the state. The act declaring municipally owned utilities to be public utilities would place these departments of municipal government under the control of the California Railroad Commission.

The initiative petition to place on the same ballot the so-called water and power act, which would provide for the expenditure of $500,000,000 by a board of five men appointed by the Governor for the development of water and power for general distribution by the state, has also been filed.

## Hoover Foresees Coal Crisis

THAT the country might have advance notice of the possibility of a coal strike, Secretary Hoover gave a statement to the press on Jan. 19 to the effect that the stage is all set for an industrial disturbance of first magnitude. Those who heard Mr. Hoover make this statement did not get the impression that the government has abandoned hope of influencing a settlement without resort to industrial warfare, but he made it very clear that no progress toward that end has been made as yet and that the line of approach has not even been indicated.

Operators continue to hold a pronounced opinion that no strike will be called. Coal specialists in the government service express the opinion that neither the operators nor the leaders in the union have any exact estimate as to the temper of the rank and file of mine workers. The anthracite workers are expected to give great momentum to the sentiment for a strike. They are well fortified with funds. It is recognized that most of the factors operating against a bituminous strike are not present in the anthracite situation. The operators in the non-union fields have assured Secretary Hoover that they will be able to attain an output of 6,000,000 tons a week in case the mines in union fields are tied up.

## Abolition of Franchise Tax in New York Is Urged

THE joint legislative committee on taxation of the New York Legislature has recommended a drastic revision of the tax laws relating to public utilities and indorsed a constitutional amendment making possible abolition of the special franchise tax. Regarding public utility taxation the report says in part:

The present system of taxing these corporations in the state is a chaos of intricacy and complexity. The staff of the committee has reduced these complicated taxes to a basis which makes possible a comparison with the taxes paid by other business interests. The grossest inequalities come to light. Many of the companies, particularly some of the electric railway companies which are bound by a fixed low rate of fare, have been literally taxed into bankruptcy.

Not all the public utilities are so unfavorably situated, because some have been more successful in their efforts to shift their burdens to the consumer through increased rates. Every class of public utility, however, pays heavier taxes than either manufacturing or financial institutions.

It is evident that the state has been using the public utilities to a considerable extent as tax collectors, imposing upon them obligations which in many cases are justified only upon the assumption that the extra burden can be passed on in higher charges to certain particular sections of the consuming public.

Completely satisfactory adjustment cannot be made until the constitution is changed so as to make practical the abolition of the so-called special franchise tax.

As an immediate means of improvement, the committee recommends that the entire series of complicated state taxes on public utilities be at once abandoned, with the exception of the special franchise tax, which cannot be immediately abandoned for the reason stated above; and that in substitution therefor a "gross net" tax be established, against which special franchise taxes, pending the passage of the constitutional amendment may be used as an offset. It is contemplated that the real estate of public utility corporations, closely defined, shall continue to be taxed locally.

## St. Lawrence Report Reaches Committees of the House

THAT part of the St. Lawrence report which is concerned with bond issues has been referred to the committee on ways and means of the House of Representatives. The remainder of the report will remain under the jurisdiction of the committee on interstate and foreign commerce, despite the vigorous efforts made on the floor of the House by Representative Dempsey of New York and others to have the report of the committee turned over to the committee on rivers and harbors.

## California Companies Issue New Securities Totaling $13,000,000

TWO new security issues have been placed on the market by California electric utilities. The Pacific Gas & Electric Company of San Francisco is offering through the National City Company of New York $10,000,000 of twenty-year 6 per cent bonds at 99½, to yield 6.05 per cent. The proceeds of the issue will be used toward the retirement of a like face amount of 7 per cent notes, secured by $16,000,000 general and refunding mortgage 5 per cent bonds, which upon release will be pledged under the first and refunding mortgage.

The San Joaquin Light & Power Corporation has issued $3,000,000 in 7 per cent cumulative prior preferred stock with the par value of $100 a share. This stock is offered at 98½, at which price it will net the investor more than 7.10 per cent. It is tax-exempt in California. Dividends are payable quarterly.

## Economic and Human Relations Discussed by President of A. S. M. E.

SPEAKING before the Chicago Section of the American Society of Mechanical Engineers on Jan. 20, President Dexter S. Kimball pointed out three fields which were essentially dependent upon engineers for the development of well-being individually, industrially and nationally. These fields were production, economical distribution and human relations. The first had been so studied and developed that little anxiety remains. Concerning the economic preparation of the engineer, President Kimball was not pessimistic, but he realized that little attention had been given by engineers to the broader aspects of economics and he thought that it was their duty to become familiar with this subject. Finally, he suggested that every engineer do what he could toward bringing about a proper viewpoint on human relations in the industries by taking part in civic affairs and working with his national and local societies.

## Closing of Last Link in Oregon-Arizona Transmission Line

ONE completely interconnected transmission system extending from the Columbia River at a point 60 or 70 miles east of Portland, thence to Portland, through Oregon, and through California into Arizona, will result from the final linking up by the California-Oregon Power Company of its transmission line from its present northern point at Prospect, Ore., to Springfield, near Eugene, Ore. The total length of the interconnected transmission system will exceed 1,200 miles.

The last section of line to be built will be 115 miles long and will be operated at 66,000 volts, which later will be increased to 110,000 volts. Over this line the California-Oregon Power Company will supply power to the Mountain States Power Company at Eugene for a period of thirty years. The line will undoubtedly result in an increased development of the rich and fertile Willamette Valley.

The transmission systems entering into the interconnection are the Southern Sierras Power Company, from Yuma, Ariz., to San Bernardino, Cal.; the Southern California Edison Company, from San Bernardino to a point near Bakersfield; the San Joaquin Light & Power Corporation, from Bakersfield to a point north of Merced; the Pacific Gas & Electric Company, from this point to a point above Redding, Cal.; the Oregon Power Company, from Redding, Cal., to Springfield, Ore.; the Mountain States Power Company, from Springfield to Salem; the Portland Railway, Light & Power Company, from Salem to Portland; the Northwestern Electric Company, from Portland to White Salmon River; the Pacific Power & Light Company, from White Salmon River to The Dalles and Tygh Valley. The Sherman Electric Company connects with the lines of the latter company at Dufur and extends to the towns of Wasco and Moro, in Sherman County, Ore.

## Industrial Heating Courses to Start Feb. 6

INDUSTRIAL electric heating courses for central station power engineers will begin Feb. 6 at the Mansfield (Ohio) factory of the Westinghouse Electric & Manufacturing Company and at the Schenectady (N. Y.) and Pittsfield (Mass.) works of the General Electric Company along the lines recently reviewed in the ELECTRICAL WORLD. On account of the pressure of work during and immediately after the holiday season upon the commercial departments of central-station companies it was found desirable to postpone the active instruction planned in these courses until the above date. A total of about twenty-eight registrants for the two courses above mentioned had been received up to Monday noon of this week, representing companies as far south as Alabama and including a good number from New England and the Middle East. During this interim the courses have been studied with the object of endeavoring to condense them into a fortnight limit.

## Chamber of Commerce Members Split Even on American Valuation

THE Chamber of Commerce of the United States has announced the result of the referendum vote of its membership of 1,400 chambers of commerce and trade organizations on the subject of the tariff. Eight separate questions were submitted in the referendum, a two-thirds vote of the membership committing the national chamber to the policy established.

The referendum declared for:

1. Legislation which would provide for adjustment of tariff rates by administrative authorities in the event of changes of economic factors. For, 1,588; against, 304.

2. Creation of a tariff adjustment board to administer adjustable rates. For, 1,379; against, 481.

3. Reasonable protection of American industries subject to destructive competition. For, 1,840; against, 27.

4. The principle of maintenance and encouragement of our export trade so far as consistent with the protection of American industries. For, 1,793; against, 59.

5. Tariff legislation to be framed and administered with a view to meeting discriminations by other countries; anti-dumping legislation of May, 1921, to be maintained in principle. For, 1,846; against, 37.

On the subject of American valuation the vote was nearly even for and against, as also was the vote as to whether tariff legislation should be postponed. The national chamber is, therefore, not committed on either.

## Los Angeles Bond Sale Declared Illegal

THE sale by the Los Angeles City Council on Aug. 2, 1921, of $13,500,000 of power bonds to finance the purchase of the distribution system of the Southern California Edison Company within the city limits has been declared illegal by the California Supreme Court. The bonds were issued to carry 4½ per cent interest, but owing to the large discount at which they were sold the Supreme Court held that the interest exceeded 5 per cent and that therefore the transaction must be set aside. The bonds were hurriedly sold by the City Council at a discount of $1,535,000.

Three years ago the city of Los Angeles entered into an operating agreement with the Southern California Edison Company whereby the latter was to operate its own distributing system in the city of Los Angeles as an agent for the city, with the understanding that on March 1, 1922, the city of Los Angeles was to purchase and take over this system. The price was determined at $11,000,000 plus additions and betterments made after the date of the agreement. Thus far these additions and betterments have equaled approximately $1,250,000.

## Detroit and New York Utility Companies Show Gains

ANNUAL reports of the Consolidated Gas Company of New York, which controls the New York Edison Company and the United Electric Light & Power Company, and of the Detroit Edison Company were issued this week. While the gas properties of the Consolidated Gas Company continue to show a loss in both output and income, electrical properties show a healthy growth.

The aggregate capital expenditures of the Consolidated and its affiliated gas and electric companies for 1921, it is stated, were $42,396,100.98, of which $33,624,175.06 was for electric property and $8,771,925.92 for gas property. It is estimated that in 1922 it will be necessary to expend for additions and extensions to the gas and electric manufacturing and distributing systems approximately $34,181,634.31.

The combined sales of gas of the various companies during the year were 36,282,751,000 cu.ft., a decrease below the previous year of 4.78 per cent.

The sales of electrical energy during the year, including that sold to the Third Avenue Railroad Company, the Brooklyn Rapid Transit Company and the New York, New Haven & Hartford Railroad Company, amounted to 1,186,346,264 kw.-hr., an increase over the preceding year of 17.25 per cent.

At a cost of $10,559,030.01 for repairs and $1,454,296.13 for renewals, or a total cost of $12,013,326.14, all of these gas and electric properties, it is stated, have been maintained in excellent repair.

The Detroit Edison Company in its annual report for 1921 shows net earnings, after deducting $3,433,665 for interest on the funded and unfunded debt, of $2,850,170. This is an increase of 37.6 per cent over the net of $2,070,936 reported for 1920, despite a decrease in output due to curtailment of industrial load. Gross revenue was shown at $23,382,898, an increase of 6.3 per cent over the $21,990,351 gross of the previous year. The company's expenses decreased 2 per cent to $17,099,062.

In his remarks to the stockholders President Alex Dow said in part:

"The operating ratio has fallen to 66.9 per cent. The ratio for 1916, which we considered to be a normal year before the war, was 54.5 per cent; in 1917 it was 63.8 per cent, in 1918 67.2 per cent, in 1919 68.9 per cent, and in 1920 77.6 per cent. The actual unit costs have also been reduced. Our largest single economy has been in the reduction in the amount of coal burned per unit of electricity produced."

## Lockwood Investigation of Incandescent Lamps Concluded

AFTER hearing testimony from officers of the General Electric Company relative to the production of electric incandescent lamps, the Lockwood legislative committee concluded for the present its inquiry on lamps. Those who appeared before the committee were Douglas Dewar and Arthur L. Brockway, accountants; A. S. Terry, supervisor of incandescent lamps of the General Electric Company; A. W. Burchard, vice-president of that company; F. S. Terry, manager of the National Lamp Works of the General Electric Company, and W. R. Burrows, manager of the Edison Lamp Works of the company.

Representing accountants for the General Electric Company, Douglas Dewar stated that the total stock issue of the General Electric Company, as of Dec. 31, 1920, was $139,026,900. Upon being asked how much of that amount represented stock that was issued for stock dividends, Mr. Dewar said there was nothing in his accounts of the last three years, during which time he has made examinations personally for the company, to show what proportion was stock dividends.

Mr. Untermyer then asked: "In addition to the stock dividends and the cash dividend, how much has the company carried to surplus?" "Well, the surplus account of Dec. 31 was $70,000,000," replied Dewar, to which Mr. Untermyer retorted: "Seventy million dollars was after writing off $115,000,000 to reserve of plant." "I do not know where you get the $115,000,000 from," Dewar answered.

Mr. Untermyer then pointed out that the figure had been obtained from the report of the directors. It was then testified by Dewar that 50 per cent of expenditures for 1920 included depreciation rates of the total capital up to that date, plus amortization of war facilities, to which Mr. Dewar added that the amount was depreciation of capital investment. The witness could not state from memory what the company's expenditures for war construction were during the years 1917 and 1918.

### Profits in Incandescent Lamp Business

Arthur A. Brockway, a certified public accountant, who audited the books of the company at Schenectady last year, testified that the General Electric Company had carried its overhead expenses on several items of manufacture to its lamp manufacturing account. The total cost of upkeep of the experimenting plant conducted by the company in Cleveland was written off to the account of incandescent lamp manufacture, Mr. Untermyer said.

That profits, amounting to 150 per cent, in the sale of incandescent lamps were made by the company was charged by Mr. Untermyer during the examination of Mr. Brockway.

Mr. Brockway testified that the 40-watt bulbs sold in retail stores for 40 cents cost the company 14.939 cents, and the 60-watt bulbs sold for 45 cents and cost

16 cents at the factory. It was also developed that the agents got 70 per cent commission on sales and that the cost of distribution and other charges had been added to the company's accounts.

A. S. Terry, who supervises the manufacture of incandescent lamps for the company, was questioned by Mr. Untermyer concerning the amounts charged licensees of the company for the use of patents controlled by the General Electric Company. Terry admitted that the General Electric charged royalties on values in excess of the selling value of the lamps. In many instances, he testified, royalties on the basis of $1.50 per lamp were charged to manufacturers who sold their particular lamps for 80 cents.

### INCANDESCENT LAMP PATENT SITUATION

Anson W. Burchard, one of the vice-presidents of the General Electric Company, was questioned as to certain financial matters. Mr. Burchard's testimony was similar to that of the company's accountant, Dewar. The vice-president stated that the company's export business was approximately 10 to 15 per cent of the total and that its capital stock was substantially $173,000,000, but when asked as to how much of the capital stock represented stock dividend he was unable to reply. He was further questioned as to patents that the company controlled and as to its plants throughout the country, and said that the company and its licensees control 95 per cent of the lamp output.

Mr. Burchard testified with reference to German and Austrian patents acquired, particularly those of Just and Hanneman and Kusel. He also told of arrangements with Siemens & Halske pursuant to which United States patents taken out on their inventions in a certain field became the property of the General Electric Company. Two of these relating to incandescent lamps had to do with the tantalum lamp and the other with a method of supporting the filament used in the tantalum lamp. The German patents of W. K. Voelker, Van Volten, Kremenitski, Hardman, Blau, Gottschalk, Hurwitz, Bergman, Reigenstrif, Shaupay, Schaller, Schumann, Schroeder, Weintraub and Frech were cited. Reference was also made to the Hoskins patent covering the resistance wire used in electric flatirons, ranges, heaters, etc., and the licenses issued by the General Electric Company to appliance manufacturers using this high-resistance wire. It was brought out that under the Hoskins license there is a schedule of selling prices to be observed by the licensee. An attempt was made to show that the General Electric Company controls the price to the jobber and the ultimate consumer. It was also brought out that the heating appliance business of the General Electric Company under the Hoskins patents has never been profitable. Mr. Untermyer then traced the ownership of the Sibley-Pitman Company to the General Electric Company and the method by which incandescent lamps of the General Electric Company are sold through General Electric jobbing houses.

Before placing William R. Burrows of Newark, manager of the Edison Lamp Works, on the stand, Mr. Untermyer placed in evidence a statement furnished by the General Electric Company upon request of the committee, covering certain salient features of the company's financial data between the years 1909 and 1920, inclusive. The statement covers expenditures on plant year by year, the amount written off, the percentage of the write-off to the expenditures year by year, the book value of the plant at the end of each year, and the sales bill and percentage off sales value to the sales bill.

Reading from this statement, Mr. Untermyer pointed out that year from year from 1901 there have been write-offs every year of the expenditures made on construction to the plant. Beginning in 1901, 65 per cent was written off the year's expenditures; in 1902 66 per cent was written off; 1903, 57 per cent; 1904, 64 per cent; 1905, 79 per cent of the total construction expenditures; 1906, 73 per cent; 1909, 85 per cent; 1915, 133 per cent, and so on.

"The lowest write-off in any of the years was the 50 per cent of the $31,000,000 spent in 1920," Mr. Untermyer said. "That was written off—no, there were two years, in which one was 45 per cent and the other 56 per cent and then a year in which there was 49 per cent written off, so that the plant in that way has been written down to $66,536,000 at the present time."

In questioning Mr. Burrows, Mr. Untermyer brought out that the General Electric lamp business is divided into two parts, fifty-fifty. The Edison Lamp Works makes about half of the lamps and the National Lamp Works of the General Electric makes the other half.

"How many lamps did you make in 1920?" Mr. Untermyer queried.

"We made 67,000,000 large lamps and I think about 40,000,000 miniature lamps, a total of a little over 100,000,000, in the Edison division," was the reply of the witness.

Mr. Burrows then stated that he thought the National division made about the same amount, making a total of about 200,000,000, and that the Westinghouse was responsible for about 50,000,000, a grand total of approximately 275,000,000 lamps for the year 1920.

"I mean to say," the witness continued, "that the licensees and the so-called infringing companies made about 25,000,000, or a little more, and of this amount the independent companies make about 3 per cent or 4 per cent—I should say perhaps 7,000,000 or 8,000,000—and the rest are made by the General Electric and its licensees," Mr. Burrows explained.

It was then brought out that there were about twenty licensees of the General Electric, representing aproximately between $3,000,000 and $4,000,000 of the actual total business, which may be $6,000,000 when based upon the list price of the General Electric.

F. S. Terry testified that Association Island in Lake Ontario off New York is owned by the General Electric Company and that its maintenance is charged to the lamp account.

## Alabama Power Completes Final Unit on Coosa River

THE completion is announced of the sixth and final generating unit of the Alabama Power Company's Coosa River development. This unit, installed at Lock 12, adds 19,500 hp. to the capacity of the plant, which it brings to 110,000 hp. for the six units. The new unit has been placed in operation and will, President Thomas W. Martin is quoted as saying, make it possible to meet the demands of normal business, although the water flow will not permit continuous operation of all six units throughout the year. Additional demands approximating 40,000 hp. are expected in 1922. The company has now completed connection of its lines through Georgia and South Carolina, creating an interchange of power between five Southern states.

## Interconnection to Be Made Compulsory in Switzerland

ABNORMALLY low water in Swiss streams has resulted in federal legislation regulating the distribution of hydro-electric power. The law as finally passed by the federal assembly makes interconnection between stations compulsory when the general advantages to be obtained warrant. When the supply of power is inadequate it is to be furnished preferentially for uses contributing most to the public good. Export of power under certain conditions is prohibited. The administration of the law is placed in the hands of the secretary-general of the Swiss Central Electric Union in order to obviate the building up of a government personnel to administer the law. The Swiss press has been attacking what it terms an overabundance of government officials.

In this connection the Swiss Federal Council has authorized a study of the question as to whether or not it is possible for Switzerland, which during the summer is able to export electric power, to import coal-produced electricity during the winter. Negotiations are in progress to that end with French companies.

## Semi-Popular Demonstration of Recent Communication Achievements

DR. F. B. JEWETT, vice-president and chief engineer of the Western Electric Company, gave a most entertaining and instructive lecture on Tuesday evening of last week, explaining and demonstrating the functioning of apparatus which has made possible the loud-speaking telephone, carrier-current communication, radio broadcasting and other marked achievements in the communication field. The demonstration was made before nearly a thousand members and guests of the New York Telephone Society at the Engineering Societies Building, New York. During the entire lecture the speaker made use of the loud-speaking telephone to enable him to address his audience without raising his voice above an ordinary conversational tone.

None of the achievements pointed out Dr. Jewett has been the result of any single development, but all are due to the combination of several, notably the wave filter and the audion in the rôle of amplifier, modulator, oscillator, rectifier, etc. The hybrid coil, an older development, has played no small part in the achievements.

Simultaneous telephone and telegraph communication by means of carrier current were demonstrated over a wire circuit and through the ether. The effect which each piece of apparatus had on the original voice vibrations or telegraph signal was demonstrated by plugging the loud-speaking telephone into the circuits at various points.

## Chicago Case to Determine if Past Losses Can Be Ignored

WHETHER a commission in its ruling can ignore the fact that losses have been incurred owing to its own slowness in fixing higher rates during a period of rising operating costs and establish a rate at a later date that will not compensate for these losses will be the issue raised in court proceedings by the People's Gas Light & Coke Company of Chicago, according to a recent announcement by Samuel Insull, its president. The Illinois Commerce Commission last week established a reduced rate for gas in the city of Chicago, and Mr. Insull in announcing that the company would put the lower rate in effect on Feb. 1, 1922, indicated that the adequacy of the rate would be tested in court and that the above question would be clearly presented. The case is expected to attract a great deal of attentions.

## International Conference on the French Superpower Transmission Systems

AT THE international conference on the French superpower transmission lines held in Paris on Nov. 21-26, 1921, a report of which has just been received, there were present forty-seven representatives of the United States, France, England, Belgium, Denmark, Spain, Holland, Italy, Japan, Norway, Sweden and Switzerland. The object was to obtain the opinions of these representatives in regard to the newly planned high-voltage transmission lines of France, tying into one extensive network the coal and water resources of that nation. The meeting was divided into three sections to consider (1) production and transformation of the available energy, (2) design of the overhead lines, and (3) exploitation of the resources. The following main points were discussed and partly agreed upon.

Under the first section two conductors per slot in alternators at a voltage of 6,000 was recommended. A high reactance and a voltage drop of 25 to 45 per cent for high-speed turbo-generators up to 43,700 kva. and 21 to 29 per cent for low-speed generators up to 7,000 kva. were considered permissible and the use of quick-acting automatic voltage regulators was held to be advisable. No definite agreement was reached as to the proper test voltage of transformers for more than 100 kv. The voltage drop of transformers, it was felt, should be between 8 and 10 per cent. It was suggested to omit voltage taps on these transformers and to ground solidly the neutral point of star-connected banks. Overload relays, it was argued, should be selected with greatest care and attention. No agreement was reached as to whether oil circuit breakers should be equipped with two or more breaks per phase. Substations up to 70 kv., it was felt, should be housed in; above that voltage the outdoor type was favored. The installation of a synchronous condenser at the different distribution centers was considered preferable to one at the end of the line. The necessity of a centrally located load dispatcher was realized.

In the section devoted to overhead lines it was felt that on lines of very high voltage—*i.e.*, 220 kv.—the use of bimetallic conductors of steel-aluminum is preferable to pure copper lines. While most countries prefer the steel-tower construction, the representatives of Scandinavia reported good success with reinforced-concrete poles. The design of steel poles, it was thought, will largely depend upon the legislative requirements for spans and crossings of public highways and property. As such vast trunk lines are of international importance, it was agreed that there should be identical laws in the separate countries governing their layout. It was brought out that in many cases too strict requirements are hampering the developments. As regarded many suggestions for crossings, use of double insulators was felt to be sufficient. A long discussion was held on the voltage distribution along chain insulators, a very detailed report on this subject

being presented by Dr. C. O. Mailloux, the American representative. Porcelain was recommended for the insulators, but tests are still under way on promising samples of basalt insulators.

Several representatives in the third section related their experiences in the exploitation of large power transmission systems. The discussion of the most suitable overvoltage protection for lines of the highest voltage culminated in a general agreement to abandon old-fashioned protective apparatus, such, for example, as horn gaps, especially when in connection with electrolytic arresters. The use of a grounding cable, laid out above the power lines, was unanimously accepted. While the grounding of the neutral point was not recommended for medium voltages, it was held to have many advantages for very high tensions. However, new and more effective means have to be found in this case to protect against telephonic disturbances. Radio communication between the individual stations, such as is in use to some extent already, was held to have much in its favor.

## City of Seattle's Light and Power Bonds to Bring 5.70 Per Cent

AN OFFERING of $250,000 of 6 per cent and $50,000 of 5 per cent municipal light and power bonds of the city of Seattle was advertised last week at a price to bring the following annual yield: 1927 to 1931, about 5.70 per cent; 1932 to 1937, about 5.65 per cent; 1938 to 1941, about 5.60 per cent. Principal and interest are payable from the gross revenues of the city's electric system.

## New Proposition Made to Power Commission on High Dam Project

A PROPOSAL whereby a license would be issued to the Northern States Power Company which would give the Municipal Electric Company the right to take over the High Dam (Minnesota) development within five years was submitted to the Federal Power Commission at its meeting on Jan. 24, and as a result final action was not taken on the High Dam applications. The Northern States Power Company has agreed to accept such a license, under which it would turn the development over to the Municipal Electric Company on being reimbursed for the actual cost of its outlay. The Municipal Electric Company had not signified its acceptance at the time of this writing.

The commission at its session on Jan. 24 granted nine licenses and six preliminary permits. Among the licenses granted were those for the important projects of the San Joaquin Light & Power Corporation on the San Joaquin River in Fresno County, Cal., and the El Dorado Power Company on the south fork of the American River in El Dorado and adjoining counties in California.

The San Joaquin corporation's project covers a construction work with 45,000 installed horsepower. The power is being used for public utility purposes. A fifty-year license was granted.

The project of the El Dorado Power Company has an estimated capacity of 40,000 hp. The applicant proposes to enlarge four existing reservoirs and to build two additional ones. In addition, a diversion dam is to be built, a power house constructed and a transmission line run to connect with the existing system of the Western States Gas & Electric Company. The license authorized carries a restriction that the storage in Echo Lake reservoir is not to be increased.

The other licenses granted are as follows: Alaska Endicott Mining & Milling Company, 350 hp., Juneau, Alaska; Central Arizona Light & Power Company, transmission line; George Inlet Packing Company, 40 hp., Revillagigedo Island, Alaska; J. H. Cann, 60 hp., Chichagof Island, Alaska; Blue Mountain Irrigation Company, 40 hp. and transmission line, La Salle National Forest, Utah; Fresh Water Bay Lumber Company, 35 hp., Chichagof Island, Alaska; Darwin Silver Company, transmission line, Los Angeles to Inyo County mines.

The preliminary permits granted covered the following projects: W. R. Banks, 300 hp., Osage River, Camden County, Mo.; Morris J. Leehey, 12,000 hp., Beaver Falls Creek, Alaska; Alaska Development & Mineral Company, 14,400 hp., Tyee Creek, Alaska; Myser & Drach, 12,000 hp., Frying Pan Creek, Col.; Hirst Chichagof Mining Company, 400 hp., Chichagof Island, Alaska; city of Boise, 12,000 hp., Payette River, Idaho.

## Electrical Men Attend Lieb Lecture for Italian Benefit

ELECTRICAL men of New York City were largely represented at a benefit lecture given by John W. Lieb, vice-president of the New York Edison Company, at Carnegie Hall on Jan. 20, for the Italian free milk and relief fund. The subject was "Leonardo da Vinci, the Master Mind of the Italian Renaissance." Mr. Lieb has been greatly interested in the strengthening of the bond between this country and the Italian people and has given much time and effort to this end. He spent several years of his early life in Italy, where he assisted in the installation of the first hydro-electric development in that country. While in Italy he became a student of the great Italian master, not alone as a painter, but as an eminent engineer of his time.

Mr. Lieb's lecture has been given before several bodies of electrical men and technical societies. It is illustrated with reproductions from the many data sheets left by Da Vinci depicting studies in mechanical and engineering as well as artistic subjects. Mr. Lieb has been decorated by the Italian government.

## Indiana Hydro-Electric Company Makes Contract for Norway (Ind.) Power

THE Indiana Hydro-Electric Company has asked the Public Service Commission of that state for authority to close three contracts for the disposition of electric power it intends to produce from a power plant it will build at Norway, on the Tippecanoe River, near Monticello. The Middle West Utilities Company is to take all the energy until 1951 and is to pay for it a sum equal to the hydro-electric company's operating expenses, interest on bonds, dividends on stocks and other expenses and charges. The Interstate Public Service Company is to take two-thirds of the output, and the Central Illinois Public Service Company is to take the remainder. They are to pay 1¼ cents a kilowatt-hour for prime energy and ¾ cent a kilowatt-hour for secondary energy.

# Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

**Worcester Company Will Make Rebates Because of Interruption to Street Lighting by Storm.**—The Worcester (Mass.) Electric Light Company will make rebates to the towns of Shrewsbury, Paxton and Leicester on account of the interruption to its street-lighting service caused by the great sleet storm of the early winter.

**Securities of Ohio Central-Station Companies Exceeded $70,000,000 Last Year.**—Despite industrial depression, the Public Utilities Commission of Ohio last year authorized the issue of public utility securities to the amount of $177,148,339. Of this amount the securities of electric light and power companies formed nearly 40 per cent, reaching $70,130,600.

**Electrical Development and German Reparations.**—The proposal that Germany should be allowed to discharge part of her reparation indebtedness to Great Britain by supplying German equipment and sending German workmen to build the new plants called for by the great scheme of electrical development and consolidation which has been sanctioned by Parliament and is now in its early stages has met with the unanimous condemnation of the British electrical associations, both technical and commercial, as well as of the electrical workmen's unions. These bodies contend that the course they condemn would increase non-employment, cheapen service, diminish national prestige, discourage embryo electrical engineers and, in short, ruin the British electrical industry.

**An Unusual Development of Hydro-Electricity in a Remote District.**—A new reservoir for the city of Bradford, England, is, according to the London *Electrician*, about to be built in the remote fastnesses of the Yorkshire moors, and all the motive power for the machinery of building is to be derived from a hydro-electric plant whose wheels will be turned by water conveyed in a pipe line from an existing reservoir. In addition, this plant will provide lighting and make possible a motion-picture show in the village which will be erected for the workmen near the reservoir site. Nor will the development be merely temporary. The colony that will remain around the reservoirs will be far from an industrial area and the district is poorly served by rail. It is hoped therefore that the hydro-electric plant will solve the fuel problem of the village and give it permanently the most modern heating, cooking and lighting facilities.

**Winnipeg Hydro-Electric System Plans Ahead.**—A survey, to extend over two or three years, for a new water-power development is being made by the Winnipeg (Manitoba) Hydro-Electric System at Slave Falls, 4½ miles above the city's present plant at Point du Bois. The plan is to operate both plants together, the combined rating to reach 170,000 hp.

**Hope Again Contends with Darkness.**—Street lights in the town of Hope, Ind., have again been turned off, and the citizens face the prospect of having to grope their way around in the dark as they did for several months last year during a quarrel between the town board and the Pulse & Porter Lighting Company. The trouble this time is with the town treasury. The old town board, which went out of office the first of the year, failed to fix a tax levy that would raise money sufficient for lighting. The new board has been forced to order the lights turned off. An issue of bonds to enable the town to meet the situation is considered.

**Polytechnic Institute Is Giving Lectures on Industrial Topics.**—The Polytechnic Institute of Brooklyn, N. Y., is giving a course of lectures on local and national problems in their relation to the industries of the Greater New York district, designed "to bring to the attention of the leading executives and business men af Greater New York the best thought and latest information regarding some of the broad topics that are at present receiving the consideration of the business world." Such men as former Secretary of Commerce W. C. Redfield, Prof. W. Z. Ripley of Harvard University and George McAneny, chairman of the New York Transit Commission, are among the lecturers.

**End of Quarter-Century Municipal Fight in Sight.**—A fight between Goshen, Ind., and the Hawks Electric Company over rates for electric light and power which started two years ago and which has often been before the Indiana Public Service Commission is about to be compromised. A preliminary conference between members of the Council, members of the Board of Public Works, the superintendent of the municipal water, light and power plant and representatives of the Hawks company has been held, and it is thought that a compromise schedule will be agreed on and pending litigation dismissed. For twenty-five years the city and the Hawks company have been competitors. Estimates of the cost of the fight to the city vary from $5,000 to $15,000, and users of electrical energy are now paying higher rates than ever before, notwithstanding that during the last two years this competition hass been unusually bitter. The Hawks company succeeded in annulling a ten-year contract to provide Goshen with energy at a low rate after the agreement had been in effect about a year. The city made the contract on the theory that it could buy energy of the Hawks company cheaper than it could generate it at the municipal plant.

# Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

**Providence Engineering Society.**—The sixth annual banquet of this society will be held on Tuesday, Jan. 31, at 6:15 p.m., in the Narragansett Hotel. Floyd W. Parsons will speak on "The Engineer in Public Service," and Capt. Daniel A. Mackay on "Public Service in the Canadian Northwest."

**Section Meetings of the A. I. E. E.**—Among the February section meetings of the Institute will be these: Providence, Feb. 3, "Radio Telephony," by W. R. G. Baker, radio-engineering department of the General Electric Company; Vancouver, B. C., Feb. 3, "Development of the British Columbia Electric Railway Company's Hydro-Electric System," by J. I. Newell; Los Angeles, Feb. 13, "The Human Voice and Its Electrical Transmission," by John Mills, engineer with the Western Electric Company.

**Public Relations Topic of Forthcoming New England Meeting.**—Addresses upon public relations will comprise the program of a luncheon-meeting of the New England Division, N. E. L. A., to be held at the New Bedford Hotel, New Bedford, Mass., Jan. 31, at 12:30 p.m. President C. L. Edgar is to occupy the chair, and the speakers scheduled are: E. L. Milliken, Woonsocket, R. I.; "Employee Relations with the Public"; W. P. Schwabe, Thompsonville, Conn., "Public Speaking"; T. C. Fales, Boston, "Relations with Bankers"; Miss O. A. Bursiel, Boston, "Woman's Public Information," and J. B. Groce, Boston, "The New England Bureau of Public Utility Information."

## Coming Meetings of Electrical and Other Technical Societies

Lighting Fixture Dealers' Society of America—Milwaukee, Jan. 30-Feb. 2.

A. I. E. E. Section Meetings—Vancouver, Feb. 3; Providence, Feb. 3; Los Angeles, Feb. 13.

A. I. and S. E. E. Section Meetings—Philadelphia, Feb. 4; Cleveland, Feb. 13; Birmingham, Feb. 25.

New Mexico Electrical Association—Albuquerque, Feb. 13-14.

Pennsylvania State Association of Electrical Contractors and Dealers—Allentown, Feb. 15.

American Institute of Electrical Engineers—Midwinter convention, New York City, Feb. 15-17. (For program see issue of Jan. 7, page 51.)

National Meter Committee, N. E. L. A.—Springfield, Ill., Feb. 15.

American Physical Society — New York, Feb. 25.

Oklahoma Utilities Association—Oklahoma City, March 14-16.

Illinois State Electric Association—Chicago, March 15-16.

Wisconsin Electrical Association — Milwaukee, March 22-24. (For program see issue of Jan. 14, page 96.)

## Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

**Fixing Rates for Dual Utility Where There Are No Data to Govern Allocation.**—In the absence of information which would have permitted it to allocate the investment and the operating expenses of a combined electric and water company, the Missouri Public Service Commission allowed for depreciation and return 11 per cent upon the combined values, holding that in such circumstances "it may suffice to fix rates which will produce a reasonable return on the combined plants, with the proviso that the rates for either plant shall be reasonable by comparison with rates at other localities of about the same size and similarly situated."

**Line Losses Due to Faulty Construction Should Not Be Reflected in Rates.**—The North Dakota Board of Railroad Commissioners in fixing rates for the Sheyenne Valley Light & Power Company found that there was an unusually heavy loss—approximately 50 per cent—in transmission, due partly to transformer loss and partly to faulty construction of transmission lines, on which steel conductors are used. The commission was of the opinion that to compel the consumers to bear the expenses of the heavy line losses would be unfair and impose an undue burden upon them, although to rebuild the entire system would involve an increase in rates to provide additional revenue for return on investment.

**Waste Caused by Competition.**—In sustaining an action to prevent the entry of a competing electric utility into the city of Idaho Springs, the Public Utilities Commission of Colorado made these observations on the fallacy of competition being the life of trade where public utilities are concerned: "This sentiment carried out to a logical conclusion invariably resulted in rate cutting, the destruction and wiping out of weaker concerns by vast aggregations of wealth, until the country is now strewn with derelicts representing hundreds of millions of wasted wealth and untold human effort and endeavor. In very many instances cut-throat competition in the end resulted in a combination of warring interests and an enormous increase in rates that were not justified and were detrimental to the welfare of the general public. To protect the public from such pernicious influences the legislatures of all our states have resorted to remedial legislation and vested courts and communities with regulatory powers to prevent the abuses spoken of."

**Letting Consumers Pay for Meters, with Refund in Installments.**—A small Wisconsin utility which because of lack of funds had difficulty in supplying its customers with meters had been connecting them without meters at a flat rate of $1.50 a month. The Wisconsin Railroad Commission condemned the practice as inconsistent with the costs of service and likely to result in a long delay in meter installation. It ordered instead that the customers pay for the meters, the company to refund the costs in installments of 50 per cent of the monthly bills.

**Lighting Ranked Above Power Service.**—The use of electrical energy for lighting purposes is in the opinion of the Idaho Public Utilities Commission a higher use than that for commercial purposes, and the lighting customers must be served first in case there is not sufficient electrical energy for both lighting and power customers. However, it is the duty of a public utility to furnish service to all its patrons, and where it cannot do this either from its own system or otherwise, a competing company should be permitted to enter the territory and fill the needs.

**Differentials in Rural Service.**—In establishing rates for rural service for the Monroe Electric Company the Wisconsin Railroad Commission said: "The applicant has asked that differentials be made in the rural charges in order to apply to consumers who have been taken on under the company's different plans. We do not believe, however, that such a plan is advisable. The utility has failed to adopt a uniform policy in the past in making its extensions, and we believe that the rural charges as outlined, in addition to eliminating the confusion incident to schedules bearing different charges, will also adequately provide for the financial needs of all rural extensions now being operated."

**Extending Transmission Lines and Fair Return.**—The Illinois Commerce Commission, dealing with the question of fair return on extensions made by the Southern Illinois Light & Power Company, which serves fifty towns in southern Illinois, held that it is not necessary for each individual extension by itself to be made to pay a fair return, but rather that the entire business of a public utility is to be considered. "In the instant case," said the commission, "service to the village of Bingham would constitute a very small percentage of the total service rendered by the Southern Illinois Light & Power Company. The fact that a small annual loss would be experienced in rendering this service would make very little difference in the return to this company upon the value of the whole property. In the opinion of the commission the consideration of the convenience of the public to be served by this extension entirely outweighs all other considerations which have been offered in evidence."

## Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

**Measure of Damage Caused by Grant of Right-of-Way.**—The Supreme Court of Wisconsin in establishing a measure of the damage caused by the grant of a telephone right-of-way (Riddle vs. Lodi Telephone Company) declared it to be the difference between the value of the premises as they were without the telephone line and the value of the premises after the line was erected, not considering the accessibility of the line to plaintiff's home. (185 N. W. 182.)*

**Injury Caused to Workman by Horseplay of Fellow Laborers Does Not Arise Out of Employment.** The Supreme Court of California has found, in Great Western Power Company vs. Industrial Accident Commission, that an injury to a workman caused by two other workmen falling upon him while they were engaged in playful scuffling did not arise out of his employment and thus did not render his employer liable for damages, no claim being made that such wrestling was habitual or that the employer had knowledge of it. (201 Pac. 931.)

**Principle of Comparative Negligence and Apportionment of Damages.**—No error was found by the Georgia Court of Appeals, in Burdasaw vs. Augusta-Aiken Railway & Electric Corporation, in this charge of the lower court to the jury: "If you find from the evidence in this case that both parties are at fault, and that the plaintiff by the exercise of ordinary care could not have avoided the consequences to herself of the defendant's negligence, she may nevertheless recover, but her damages shall be diminished by you in proportion to the amount of default attributable to her." (109 S. E. 530.)

**New York's Transit Commission Not an Unconstitutional Body.**—In a unanimous decision the Court of Appeals of New York State has held that the Transit Commission act passed by the Legislature of 1921 was constitutional and that the Board of Estimate and Apportionment of New York City must hand over to the Transit Commission the sums it had asked for. The Board of Estimate declined to honor these requisitions, and the Transit Commission applied to the Appellate Division, First Department, for an order requiring the board to make such an appropriation. Again the board refused, and took the case to the Court of Appeals. It is understood that the case will go to the Unied States Supreme Court.

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

# Men of the Industry

**Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry**

**Charles R. Wanneman** has been appointed chief engineer of the New York Public Service Commission. In 1910 he was made inspector of the old Second District commission in the division of transportation. In 1914 he became chief of division of steam railroads, and in 1918 his duties were extended to include those of the engineer of grade crossings. Later he had charge of steam railroads, electric railroads and grade-crossing eliminations in the state outside of Greater New York. His new position as chief engineer places him in charge of engineering and inspection work, for the commission, of all steam railroads, street railroads, grade crossings, electric light companies, gas companies, telephone and telegraph companies throughout the state. Previous to his appointment on the old commission Mr. Wanneman was acting chief examiner of the State Civil Service Commission and assistant engineer for the State Engineer and Surveyor. Prior to that he had been for some time in the employ of the Pennsylvania Railroad. He is a graduate of Cornell University and resides in Albany.

C. R. WANNEMAN

**Charles W. Price**, who has just retired as editor of the *Electrical Review* after nearly forty years in the editorial chair, was the guest of honor at a luncheon given by a number of his friends in the electrical industry on Jan. 18 in New York at the Lotos Club, of which Mr. Price has also long been secretary. Appreciative tributes to Mr. Price's veteran service to the electrical industry were paid in brief addresses by E. W. Rockafellow, Western Electric Company; Gen. J. J. Carty, American Telephone & Telegraph Company; O. H. Caldwell, representing James H. McGraw, president McGraw-Hill Company; F. S. Terry, General Electric Company; A. Wilson-Lawrenson, National Carbide & Carbon Company; W. L. Goodwin, Society for Electrical Development, and others. Messages of regret were also received from Henry L. Doherty, Chester S. Lord and M. H. Aylesworth, who were absent from the city. As already noted in these columns, the *Electrical Review*, over which Mr. Price so long presided, has been purchased by the McGraw-Hill Company, which will continue to publish it in Chicago, but as a monthly magazine for practical maintenance men, under the title *Electrical Review and Industrial Engineer*.

**F. M. Feiker**, vice-president of the McGraw-Hill Company, who for the past eight months has been assisting Secretary Hoover in the reorganization of the Department of Commerce, has resigned. Mr. Feiker has not, however, completely severed his relations with the Secretary or the department. He has been appointed a special agent of the Bureau of Foreign and Domestic Commerce, to continue in a consulting capacity the work he has been doing. Last May Mr. Feiker received leave of absence from the McGraw-Hill Company to join the Department of Commerce as a special administrative assistant of Secretary Hoover. He was selected because of his very wide knowledge of and experience and acquaintance in the American industrial field.

Under the direction of Mr. Feiker and Dr. Julius Klein, Director of the Bureau of Foreign and Domestic Commerce, the industrial and business contacts of that bureau have been enlarged, business relations with trade association committees have been established and the so-called commodity divisions of the bureau created. Mr. Feiker has drawn some fifty or sixty experts from the business world to the Department of Commerce to be of direct and specific service to American business. During Mr. Feiker's stay with the department, *Commerce Reports*, the government's official foreign trade paper, has been changed from a daily to a weekly publication and its style and appearance have been completely altered to meet more nearly the needs of business. The *Survey of Current Business*, a new publication destined to be of much assistance to American business men, was brought into existence. Mr. Feiker's services extended to the Bureau of Standards, the Bureau of the Census and other parts of the department. He served as editorial adviser on the department's board of editors.

**L. J. Moore**, formerly electrical engineer, has recently been appointed executive engineer of the San Joaquin Light & Power Corporation, Fresno, Cal. Mr. Moore has had a quite varied experience in electrical engineering and is well known on the Pacific Coast through his activities in the technical societies. He was born April 27, 1885, in Iowa, and was graduated from the Iowa State College in electrical engineering in June, 1908. Immediately therafter he was employed by the Telluride Power Company in Utah, following which he became instructor for the Telluride Institute. In 1911 he entered the employ of the San Joaquin Light & Power Corporation, holding various positions as inspector, construction foreman, maintenance foreman, chief dispatcher, technical assistant to the general superintendent, and finally, in 1918, was promoted to the position of electrical engineer. In that position he had charge of the design of transmission lines, substations and generating stations, including both steam and hydro-electric stations, among the latter being included two automatic generating stations. Mr. Moore is an associate member of the American Institute of Electrical Engineers and is chairman of the apparatus committee of the Pacific Coast Electrical Association. His present position as executive engineer is virtually that of technical assistant to the general manager of the corporation.

L. J. MOORE

**Victor Bagley**, for the past two years line superintendent Central Maine Power Company, Augusta, Me., has resigned to take up a line of work outside the electrical field. Mr. Bagley began electrical work thirty years ago as a lineman with the Bath & Brunswick Light & Power Company and later became district superintendent, from which post he was advanced to the supervision of the entire Central Maine system.

**G. W. Atkinson** has resigned as electrical engineer of the United States Armory, Springfield, Mass., and has been appointed superintendent of power and maintenance of the Gilbert & Barker Manufacturing Company, Springfield. Mr. Atkinson was born at Morocco, Ind., in 1883, and received the degrees of B.S. and E.E. from Purdue University in 1908 and 1911. In April, 1909, he entered the office of the Supervising Architect, Treasury Department, Washington, D. C., as electrical and mechanical engineer, dealing

G. W. ATKINSON

with the design, construction and operation of all mechanical equipment entering into federal buildings and including a large number of power plants. In this post Mr. Atkinson performed a large amount of inspection work in three-fourths of the states of the Union. From June, 1917, to Jan. 1, 1922, he was electrical and consulting engineer at the Springfield Armory. Here he had charge of design, construction and operation of all steam and hydro-electric power plants, the complete electrification of all shops, signal systems, buildings, road work, factory facilities, etc. This work in general included advancing the type of equipment from that of the Civil and Spanish wars to modern standards, and this was done virtually without shutdowns. Mr. Atkinson is an associate member of the American Institute of Electrical Engineers and a director of the Engineering Society of Western Massachusetts.

**E. T. Martin**, formerly associated with the miniature-lamp sales department of the National Lamp Works, General Electric Company, has been appointed assistant to the manager of the Federal Miniature Lamp Division, New York City.

**William E. Skinner**, formerly with the electrical department of the Chicago, North Shore & Milwaukee Railroad, has formed the Associated Engineers, Inc., with offices at Milwaukee, Wis. He is vice-president of the company and will have the active management. Mr. Skinner is a member of the A. I. E. E., the A. A. E. and the Society of American Military Engineers. He holds a reserve commission in the United States Army.

**F. W. Price**, for a number of years Southern district manager of the Apex Electric Distributing Company, has been appointed Eastern district manager in charge of the territory of metropolitan New York, eastern Pennsylvania, New Jersey, Maryland, West Virginia and Virginia.

**Roy M. Brown**, formerly assistant sales manager in charge of advertising for the Apex Electrical Manufacturing Company, Cleveland, has been appointed vice-president and general manager of Andrews, Brown & Cole, Inc., successors to the Morton Company, Cleveland.

**Daniel G. Head**, for several years field representative in the New England territory for the Federal Miniature Lamp Division of the General Electric Company, has become sales manager for the Culver-Stearns Manufacturing Company, Worcester, Mass., manufacturer of automotive electric lighting accessories. Mr. Head has had a number of years of experience in the field of automotive electric lighting.

**Herbert Metz**, who has been connected with the farm electric equipment department of the Western Electric Company for a number of years, has been appointed power and light sales manager, with headquarters at the company's general offices in New York. Mr. Metz was graduated from Pennsylvania State College in 1914 and became connected with the company shortly afterward, taking the commercial student course at the company's Hawthorne plant near Chicago. In 1915 he took a position in the advertising department in New York. Later he spent a year in the Rocky Mountain territory doing sales promotion work. For the last two years he has been in charge of farm electric light plant advertising in the New York office and has been closely connected with the extensive farm-lighting plant campaigns of the company.

**Albert J. Young, Jr.**, formerly manager of New York district sales for the Sprague Electric Company, has been made manager of the conduit and supply division of the company. Mr. Young has been with the Sprague company during his whole business career, starting in its employ as a clerk in the cost department in 1903. Three years later charge of the cost department was given to him. In 1907 he was transferred to the sales department as inside salesman, and a little more than a year afterward received

A. J. YOUNG, JR.

the appointment of sales agent in the metropolitan district. This position he held until 1920, when he was made manager of sales for the New York district.

**T. H. Hays** has been appointed manager of the Indianapolis office of the Westinghouse Electric & Manufacturing Company.

**H. W. Cross**, for several years turbine engineer for the General Electric Company in its Chicago office, has been made the head of the Boston office of the C. H. Wheeler Manufacturing Company.

## Obituary

**Charles P. Praitsching**, who for a number of years covered the New England States and part of New York State for the sales department of Shapiro & Aronstein, Inc., manufacturers of lighting fixtures, died on Dec. 15, 1921.

**Frank N. Jewett**, who had been associated with the Wagner Electric Manufacturing Company for the past twelve years, died at his home in St. Louis on Jan. 4. Mr. Jewett had been in failing health for the last two years. He was a member of the Electric League, the St. Louis Electrical Board of Trade and the A.I.E.E.

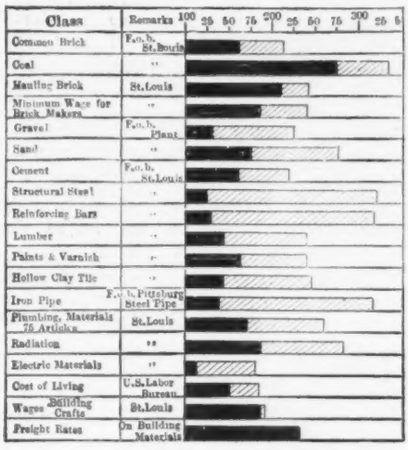
**Charles F. Schneider**, general factory superintendent of the Robbins & Myers Company, Springfield, Ohio, died from an attack of acute indigestion suffered at the plant of the company on Jan. 12. Mr. Schneider was appointed general factory superintendent only recently. He entered the employ of the company in 1897 as foreman of winding, and wound and assembled with his own hands the first power motor ever built by the company. He gradually worked his way up from this position to that of superintendent of Plant No. 1, holding this place for a number of years until his recent promotion to the position of superintendent of all plants. Previous to his employment by the Robbins & Myers Company Mr. Schneider had several years' experience in central-station work.

# Trade and Market Conditions

**Business Reviews, Together with Market Letters from Important Trade Centers, on the Supply, Demand and Prevailing Prices of Electrical Apparatus and Supplies**

## St. Louis Jobber Sees More Business, Less Liquidation in 1922

THE volume of jobbing business in 1922 will probably be somewhat larger than it was in 1921, according to H. N. Goodell, St. Louis district manager of the Western Electric Company, interviewed recently by a representative of the ELECTRICAL WORLD and, on account of fewer price drops should be more profitable. Electrical materials, as shown in the accompanying chart, said Mr. Goodell, did not increase in price proportionately with other materials and with the reductions which have been made are well in line for 1922 business. The volume of business this year has been between 30 per cent and 40 per cent less than that of last year.




Comparative Prices on Building Material in St. Louis

1913 Price Level =100 Maximum Price Level in 1920 Price Level in October 1921

CHART SHOWING THAT ELECTRICAL MATERIALS DID NOT INCREASE PROPORTIONATELY WITH OTHER PRODUCTS

"Certainly no boom is expected in 1922 business," Mr. Goodell continued, "and any further increases will come quite gradually. Better crops and better values for farm products will be of considerable general help and should directly aid the sale of farm-lighting outfits. Liquidation of costs of building materials and labor is necessary, and this is slowly being obtained. The new construction work next year will be principally of institutions and residences as most of the industrial concerns are now overbuilt and will be until the industrial situation is substantially improved. The central-station companies are expected to continue their expansion, and in the resultant business the jobbers will naturally find their share. An optimistic view of 1922 business is entirely warranted."

## Steel-Pole Market More Active Since First of Year

INQUIRIES for and sales of steel poles and transmission towers have improved considerably since the first of January, according to a survey of conditions in that field. Sales are better than during the entire last quarter of 1921. The month of December was naturally very slow, business being held over for various reasons until the new year. One of the important reasons for delaying orders until then was the fact that on Jan. 1 the war tax on freight bills was eliminated. This came to a large figure on a carload of steel poles.

There are many inquiries for steel poles and towers, and investigation discloses that these queries are the forerunners of much proposed spring construction. There are quite a number of combination railway and lighting pole jobs awaiting favorable action by property owners in various cities. The street-railway companies are buying only such poles as are necessary, on account of their generally poor financial condition. On the other hand, central-station companies and those municipalities owning their own lighting poles are in much better financial condition. One solution of the problem put forward by an interested manufacturer is to have the lighting company collect sufficient funds to provide steel poles for lighting and charge a proportion of their cost to the street railways for use as span supports. One company reports some export inquiries, but foreign exchange conditions militate against export sales.

Current prices are said to be on a level with those prevailing in June, 1916. There was a general drop in prices during the last quarter of 1921. The market at the present moment is firm, and it is doubtful whether there will be any further downward movement for some time to come. Deliveries are good, ranging from thirty to sixty days on tubular steel poles and from one to three weeks on steel towers.

The outlook, manufacturers agree, is for better business all through 1922 than during 1921. The increase is expected to be very gradual but permanent.

## Insulators Quiet, with Improvement Looked for in Spring

THE insulator market in the last two months has become uniformly quiet, but manufacturers are a unit in looking for a good demand to develop early in the spring. That there is a large volume of line construction needed and proposed for spring is known. One manufacturer states that a number of large inquiries are now developing into negotiations. Last spring many central-station companies would have gone ahead with extensions and new lines if it had not been for the tight money market and the high price of materials. Since that time there has been a general price liquidation in this line and money can be obtained much more cheaply. For these reasons producers of insulators are expressing confidence that early spring will see a revival of sales.

Current sales are reported as somewhat spotty. Some manufacturers state that they have been small but steady all during the past year and that neither December nor the first part of January showed any improvement over the previous twelve months; other manufacturers are experiencing a demand running from 60 per cent to 80 per cent of the 1920 demand. With some companies there was a flurry of sales early in the fall, and for a short time production was just about able to keep ahead of orders. This was momentary, and at the present there are practically no producers working full time.

Deliveries are about normal. Some plants have attempted to carry certain popular sizes and as a general rule can make prompt shipments. Goods which must be manufactured after receipt of order can be immediately put in process, and normal delivery is from three to six weeks, depending on the class of material. Glass insulators can be shipped in 3 to 4 days in ordinary quantities. Prices of both the high-tension porcelain and the glass insulators were dropped about 10 per cent early in January by several large manufacturers. A few companies have guaranteed them for the first quarter. The decrease was the third in a year, and it is estimated that the cost of this product is 25 per cent below the high level reached in 1920. There is no expectation among the manufacturers of any further liquidation in the near future.

## Brazilian Electrical Market Quiet

THE market for electrical goods in Brazil is quiet at the present time, according to advices received from an official of an American electrical manufacturing company who is stationed there. This situation is due in part to the exchange problem and in part to liquidation of prices in this country. The Brazilian public feels, said this official, that as long as the exchange value of the milreis is only about half as much as normal, investment in American electrical goods will not bring a proper return. However, the country is moderately prosperous, and the exchange condition would not prove such a deterrent to buying if Brazil was convinced that liquidation of prices here had come to an end. The American public has reached this frame of mind, and it is only a matter of time before it will be communicated to the South American republic.

The future of Brazil electrically, he continued, is very bright. The population of the country is slightly in excess of 25,000,000. Of this number about 7,000,000 may be considered as a prospective market for electrical goods. The country is one of almost unlimited water power and as is well-known has other great natural resources, the development of which will demand the use of this water power. There are many large electrical projects under consideration, but virtually all of them are being held up temporarily on account of financial considerations. Thus the market for large electrical equipment has been virtually dormant for some time. There has, however, been a good market for wiring supplies, appliances, lamps and other small electrical products.

The most serious competition encountered by American firms in Brazil, he remarked, is of German origin. People in Brazil have no particular animosity toward Germany and so lower prices give the German manufacturer a temporary advantage. However, this cannot last long, he said, for Germany is conducting a gigantic bankruptcy sale and cannot continue it indefinitely. Contrary to general expectations, deliveries of German-made goods, including even locomotives, heavy machinery and fabricated material, were good for some time after they re-entered the Brazilian market. At the present they are lengthening, and, it is thought, will continue to increase. There has been no marked importation of the new German incandescent lamp into Brazil.

## December Electrical Exports Bring 1921 Total to $95,814,885

EXPORTS for December, 1921, amounted to $5,177,276 and showed an increase over the preceding month of nearly $1,000,000. This figure does not compare with the total for December, 1920, which saw American electrical manufacturers selling $13,812,180 worth of their product to foreign customers. In spite of the decline in exports which began in March, 1921, the total for 1920 was only $6,175,119 in excess of 1921 exports, as shown in the accompanying table. Leading authorities estimate that electrical materials have shown an average drop of 15 per cent from 1920 prices so that while the value of all electrical goods exported has dropped about 7½, the volume has actually increased over 1920. With this in mind as well as the 20 per cent increase registered by December, 1921, as compared with the previous month, electrical exporters are justified in taking an optimistic view of the future.

In eight of the items listed 1921 showed an increase over 1920. These include dynamos and generators, insulated wire and cable, carbon-filament lamps, meters and measuring instruments, motors, telegraph and telephone apparatus. Motor exports showed the largest total, amounting to $15,444,564, about $2,000,000 ahead of the previous year. Transformers had the largest percentage of gain, their value, $7,988,440, being 66.5 per cent ahead of last year. The greatest decrease in volume was shown by batteries, which dropped from $6,633,542 to $3,831,738, or almost 50 per cent. Other large drops were noted on carbons, interior wiring supplies, metal filament lamps and heating and cooking apparatus.

As compared with the previous month, December showed increases in batteries, dynamos and generators, heating and cooking apparatus, metal-filament lamps, meters, motors, switches, telegraph and telephone apparatus and miscellaneous items. Decreases were shown by fans, carbons, insulated wire and cable, interior wiring supplies, transformers and several other items. The largest increase was on motors, amounting to almost $500,000, or 100 per cent.

| | December 1920 | December 1921 | 1920 Total | 1921 Total |
|---|---|---|---|---|
| Batteries | $649,769 | $176,580 | $6,633,542 | $3,831,738 |
| Carbons | 123,793 | 29,430 | 1,477,831 | 433,869 |
| Dynamos and generators | 1,487,282 | 620,831 | 7,796,305 | 7,942,473 |
| Fans | 257,432 | 29,165 | 1,364,742 | 1,270,253 |
| Heating and cooking apparatus | 206,548 | 73,818 | 1,801,127 | 1,637,450 |
| Insulating wire and cable | 1,301,307 | 362,899 | 8,208,539 | 8,573,820 |
| Interior wiring supplies | 442,129 | 82,184 | 3,386,068 | 1,848,793 |
| Arc lamps | 2,610 | 938 | 25,098 | 13,795 |
| Carbon-filament lamps | 19,622 | 3,070 | 114,542 | 125,045 |
| Metal-filament lamps | 463,487 | 145,537 | 4,051,835 | 3,148,635 |
| Magnetos, spark plugs, etc. | 314,185 | 34,607 | 3,601,419 | 1,313,614 |
| Meters and measuring instruments | 332,314 | 121,811 | 2,676,548 | 2,726,448 |
| Motors | 1,702,846 | 950,285 | 13,421,550 | 15,444,564 |
| Rheostats and controllers | 81,569 | 33,649 | 707,719 | 1,044,393 |
| Switches and accessories | 568,343 | 105,907 | 4,438,709 | 4,033,299 |
| Telegraph apparatus | 101,605 | 54,165 | 713,798 | 1,010,891 |
| Telephones | 544,068 | 319,768 | 3,898,987 | 4,797,923 |
| Transformers | 696,057 | 258,602 | 4,803,158 | 7,988,440 |
| All others | 4,517,214 | 1,774,030 | 32,868,433 | 28,628,982 |
| Total | $13,812,180 | $5,177,276 | $101,990,004 | $95,814,885 |

In not a single item is there found an increase over the same period in 1920. The figures in the accompanying table were obtained from the Bureau of Foreign and Domestic Commerce, Washington, D. C.

## Metal Market Situation

THE week opened with both consumers and producers of copper indifferent, an attitude that is apt to last for some time. Consumers have practically covered their needs for the next sixty days, while the large producing companies made large enough sales in the last quarter of 1921 to carry them through a quarter of dullness. Some of the smaller producing interests are showing a disposition to sell at concessions. Probably in the hope of assuring themselves outlets when new supplies come from the companies about to resume operations. These small producers are offering electrolytic for shipment even into the second quarter for as low as 13¾ cents delivered, while the general market is at 13¾ cents to 14 cents per pound.

Export demand is light. For several days there has been little buying of American electrolytic, and the tone of the market continues consistently weak. On Monday, Jan. 23, there were no exports from the port of New York at all. The week before the outgo was 3,185 tons, more than half of which went to Germany. Total exports for 1921 were 278,145 tons, the largest since 1918. These exports, however, included some manufactured shapes and contents of copper sulphate.

Tin prices have been weak during the past few days. The London market declined £3.17.6 to £4 per ton, and as a result the price of tin in New York is ¾ cents per pound lower.

### NEW YORK METAL MARKET PRICES

| | Jan. 17, 1922 | Jan. 24, 1922 |
|---|---|---|
| Copper: | | |
| London, standard spot | £ 65 s. 2 d. 6 | £ 64 s. 17 d. 6 |
| | Cents per Pound | Cents per Pound |
| Prime Lake | 13.75–13.87½ | 13.75 |
| Electrolytic | 13.62½ | 13.50–13.62½ |
| Casting | 13.00 | 13.00 |
| Wire, base | 15.00–15.25 | 15.00–15.25 |
| Lead, Am. S. & R. price | 4.70 | 4.70 |
| Antimony | 4.45 | 4.45 |
| Nickel, ingot | 41.00 | 41.00 |
| Sheet zinc, f.o.b. smelter | 8.50 | 8.00 |
| Zinc, spot | 5.07½ | 5.00 |
| Tin, straits | 32.12½ | 31.37½ |
| Aluminum, 98 to 99 per cent | 19.10 | 19.10 |
| **OLD METALS** | | |
| Heavy copper and wire | 11.25–11.50 | 11.00–11.25 |
| Brass, heavy | 5.25 –5.37½ | 5.00– 5.25 |
| Brass, light | 4.50 –4.87½ | 4.50– 4.75 |
| Lead, heavy | 4.00 –4.12½ | 4.00– 4.12½ |
| Zinc, old scrap | 2.50 –2.62½ | 2.25– 2.37½ |

# THE WEEK
## IN TRADE

**Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points**

MANUFACTURERS and distributers the country over report business steady but light. Colder weather in some portions of the country has interfered with building, and wiring supply demand has fallen off somewhat, while stocks remain good. Nevertheless as soon as building is resumed it will be found, according to many jobbers, that stocks of wiring materials are none too large. Appliance sales continue to be spotty. Those which require the smallest initial investment are meeting with less sales resistance.

Indications still point to good business. In Boston construction steadily forges ahead of 1921 figures and contractor-dealers find no dearth of work. Three steam-turbine installations in New England were closed during the week. Chicago notes a good call for safety switches. Inventories there are over and the industry in the Middle West is going after business again. Atlanta jobbers are stocking fans in about the same quantities as last year. A good demand for engine-generator sets by small industrial concerns and municipalities has been noted in St. Louis.

Several price changes have been reported during the week. Glass insulators are down 5 to 7½ per cent in Chicago. Rigid iron conduit is down 5 per cent in Atlanta. High-tension insulators have dropped 10 per cent in the Pacific Northwest.

### NEW YORK

Quiet seemed to pervade the electrical trade last week. Little change in conditions was noted, and jobbers report that the demand for wiring material is only moderate. Stocks have been pretty well reduced, and jobbers are ordering from manufacturers in quantities just sufficient to keep somewhat ahead of the demand. In general, wiring supplies are moving slowly and most contractors are buying for immediate requirements only. Price competition is pretty keen on some items, and in some quarters it is not uncommon to make concessions in this respect to obtain the business. Quotations, however, remain about the same as reported last week.

With the exception of air heaters, flatirons and vacuum cleaners, the appliance business is sluggish. Recent cold weather and the drop in prices have materially stimulated the demand for heaters. One item on which the jobbers and manufacturers have been unable to meet the demand is the small radio receiving set which retails between $25 and $30. It is stated that one manufacturer at present has unfilled orders for 200,000 of these sets.

With the announcement of the reduction in price of fans the jobbers are now making contracts with dealers for this year's requirements. The new list prices on 12-in. and 16-in. fans average about 12 per cent reduction as compared with 1921. Jobbers, generally have a small carry-over from last year.

**Rigid Conduit.**—Stocks are moderate but easily ample to meet the present demand. Quotations remain about as reported last week, most jobbers' prices already virtually conforming to the new card issued by the manufacturers. The following prices were quoted this week: For ½-in. black pipe in 2,500-ft. lots, $44.90 to $46; ¾-in., $57.70 to $59, and 1-in., $82.85 to $85 per 1,000 ft. Galvanized pipe in the same sizes and quantity was quoted at $48.70 to $50, $64.35 to $66 and $91.65 to $93 per 1,000 ft.

**Rubber-Covered Wire.**—Conditions and prices in the wire market remain unchanged. No. 14 rubber-covered is quoted at $6.50 to $6.93 per 1,000 ft. in 5,000-ft. lots. Demand is moderate and jobbers' stocks are good.

**Flexible Armored Conductor.**—Demand for this material is fairly active, although a great deal of the business is taken on a competitive price basis. No. 14, two-wire, single-strip, is quoted from $43 to $45 per 1,000 ft. in that quantity. Double-strip is quoted from $45 to $47 per 1,000 ft. Jobbers have fair stocks and deliveries from manufacturers are much better.

**Tape.**—Both friction and rubber tape are quoted at 36 cents a pound in 100-lb. lots. Sales are in line with those of other wiring supplies and jobbers' stocks are ample.

**Sockets.**—Trade is fair and prices remain unchanged. Key sockets in standard-package lots of 500 are quoted at $18.15 per 100 and keyless in the same quantity at $16.50 per 100. Pull sockets in lots of 250 are quoted at $33 per 100.

**Lighting Fixtures.**—Commercial lighting fixtures, particularly those of the unit type, have been moving satisfactorily, while the demand for industrial reflectors has not been so good. Incandescent lamp sales to industrial companies are increasing, which is taken as a forecast of industrial activity. Sales of residential fixtures are spotty.

### CHICAGO

Another week of comparative dullness in the electrical industry has passed, but the majority of dealers and jobbers have finished their inventories and are out after business. The return of activity in wiring materials has been slow but fairly steady since most of the orders are in small lots. Jobbers report a good call for the inclosed safety switches. Manufacturers of high-tension equipment announced several good sales during the week. Activity on poles and pole-line hardware has been rather dull for several weeks, but a better movement is now reported. A price reduction of 5 to 7½ per cent has been noted on glass insulators.

**Wire.**—Movement of No. 14 rubber-covered shows little change. While a few jobbers have been selling a fair amount, the majority of them report that buying has been slow. This wire is still available in 5,000-ft. lots for $6.75 to $6.85 per 1,000 ft. Neither the demand nor the price for weatherproof and bare wire has changed since the former is holding at 16¾ cents while the bare-wire base is 16¾ cents.

**Rigid Conduit.**—Stocks are good and there is a moderate demand, but jobbers state that the majority of orders are in small lots. The ½-in. black pipe is quoted at $46 to $47 per 1,000 ft. in 5,000-ft. lots.

**Flexible Armored Conductor.**—Action on this material has been steady and jobbers report their stocks ample but not excessive. The No. 14 two-wire, double-strip, sells for $47.50 per 1,000 ft. in 5,000-ft. lots. For the single-strip it is quoted at $45 per 1,000 ft.

**High-Tension Equipment**—During the week one manufacturer sold a 1,200-kw., 44,000-volt substation to a cotton mill, one 600-kw., 22,000-volt substation for irrigation purposes in the West and some heavy busbars of the cantilever type for a Middle West central-station company. This company reports an inquiry on 66,000-volt switching equipment for a railroad electrification in South Africa. Another company reports a sale of a complete 5,000-kw., 66,000-volt substation to a sheet and tin-plate company in Ohio.

**Safety Switches.**—The demand for the 30-amp., two-pole switch has been on the increase, but stocks on hand are still sufficient to supply the normal requirements.

**Poles.**—Prices on Northern white cedar poles are firm and dealers report a slightly improved market. The 7-in.-top, 30-ft. Northern white cedar, f.o.b. Chicago in car load lots, is quoted at $8.40. This same size in a Western red cedar pole sells for $7.30. All dealers report stocks in good shape.

**Pole-Line Hardware.**—Prices on this material have not changed for some time and stocks are ample. While the movement of late has been rather slow, much better sales are expected by most dealers in 1922.

**Insulators.**—A price reduction on glass insulators of 5 to 7½ per cent has been noted. The regular 5,000-volt porcelain insulator in common use at central stations is quoted at $56.80 per 1,000 in lots of 1,000 f.o.b. Muncie, Ind.

## BOSTON

Some improvement in trade is apparent, although day-to-day business is rather spotty. Building operations continue to run into larger totals than for this time last year. The textile mills are active and wage reductions averaging about 20 per cent have been instituted in some localities. Mercantile business appears to have made a good start this year. Central-station companies are picking up on outputs, and new steam-turbine installations will soon be made at New Bedford, Mass. (20,000 kw.), Manchester, N. H. (12,500 kw.), and for the United Electric Railways Company of Rhode Island (15,000 kw.) Appliance sales, while losing some of the impetus given during the holidays, are still fair in the lighter lines. Contractor-dealers are active in the wiring of both old and new residences, and considerable office building wiring is to be done in connection with new construction.

**Wire.**—Rubber-covered wire is moving around $6.75 per 1,000 ft. for No. 14 in 1,000-ft. lots, to meet the needs of scattered building wiring work now under way. The total of this work is respectably large, however. Demand for weatherproof and bare wire is devoid of spectacular features. Stocks are plentiful.

**Lamps.**—Continued fair business in lamps is noted. The demand is well diversified and stocks are easily meeting it. Interest in better industrial lighting shows no signs of slackening.

**Loom.**—Prices softened this week and stocks are still larger than current demand necessitates. In 5,000-ft. lots $\frac{7}{32}$-in. loom sells at $14.75 per 1,000 ft. and $\frac{1}{4}$-in. loom in the same quantity at $17.50.

**Motors.**—This line has not yet hit its stride for the year, but a great deal of proposition work is in hand and interest in the improved driving of machinery is clearly reviving in many parts of this territory.

**Rigid Conduit.**—Sales are uneven, but some pick-up business is coming along most of the time. Little is heard at present about stocks being too large, buying by jobbers having been light for so long. The distinct improvement noted in the building industry is likely to increase buying moderately in this line before many months. One-inch black pipe sells for $90.77 per 1,000 ft., in 5,000-ft. lots, and galvanized at about $100.

**Fixtures.**—Sales are beginning to reflect somewhat greater demand resulting from the construction of new residences and mercantile buildings. Stocks of distributers are still large in representative cases and little buying from the factories has been in evidence for some time. Prices are reasonably stable with some exceptions in retail circles.

**Washers.**—Revived interest is noted in various sections as a result of vigorous sales effort and renewed emphasis upon quality of product.

**Storage Batteries.**—Good movement of batteries for oil-switch operation and for railroad car lighting is reported. The demand for starting and lighting batteries is not yet very active. Stocks are sufficient and prices firm.

## ATLANTA

Business has not yet entirely recovered from the slump following the holiday and inventory period, though there are numerous indications that the volume of business is slowly returning to a more normal basis. Few consumers are as yet placing heavy orders for restocking, indicating that confidence in the present scale of prices is not yet restored. Jobbers report a heavy number of inquiries for quotations, especially on certain classes of line material, pipe, wire and cable, thus indicating that orders will materialize as soon as purchasers feel that stable prices have been reached. The new year in Atlanta started off with an excellent record for new construction, the first fifteen days having piled up permits to the value of $800,000, an excess over the entire month of January, 1921. Active steps are also being taken for improvements under the recent bond issue and the general outlook is that this city will enjoy a prosperous building year in 1922. Business conditions in the rural districts still continue rather dull, and it is generally expected that more failures will be recorded in the months of January and February than in prior months.

**Rigid Conduit.**—With a brisk movement in this line, a price reduction of 5 per cent becomes effective this week. Heavy inquiries are being received for $\frac{1}{2}$-in. pipe, while the larger sizes continue very popular. Stocks are in good condition.

**Outlet Boxes.**—Fairly satisfactory sales are reported particularly on the smaller type of boxes used in residential work. The larger sizes continue to hold up quite well. No recent price changes have been recorded and local stocks are in good shape.

**Wire.**—Rubber-covered and varnished-cambric varieties are quite active, the latter more so than for some time past. Weatherproof is somewhat slow. Inquiries for the latter type, however, indicate a pick-up in the near future. Local stocks on all varieties are in good condition.

**Fans.**—Following the announcement of fan prices and preparation of contracts, jobbers report that orders for spring stocks are beginning to materialize. The general outlook seems to be that sales in 1922 will compare favorably with those of 1921, though, of course, weather conditions play a prominent part in this connection. Jobbers are stocking in quantities about equal to 1921.

**Pole-Line Hardware.**—This line is moving quite satisfactorily with considerable quantities going to small municipalities and steam railways. Inquiries on hand indicate a continued satisfactory movement in this line for some weeks.

**Poles.**—Sales of poles are not keeping pace with pole-line hardware, such purchases as are made being for maintenance. Municipalities are purchasing in small quantities. Pole yard stocks are in good shape.

**Flexible Non-Metallic Conduit.**—Sales have again been resumed, though they still have not entirely recovered owing to the flooding of the market some months ago. Local stocks are in good shape with $\frac{7}{32}$-in. being offered at $21 per 1,000 ft. in lots of 5,000 ft.

**Sewing Machines.**—This is about the only specialty in household appliance lines that is showing any activity. For the first time in many months sales are being registered and inquiries show a steady increase. Stocks are excellent.

## ST. LOUIS

The controversy over wages in the building trades here is creating considerable interest in the electrical industry, for the amount of new construction work which will be projected this year will be materially influenced by its outcome. As was anticipated, the union organizations composing the Building Trades Council have rejected a proposal for a reduction from $1.25 to $1 per hour. However, it is reported that wage reductions on all future wage contracts will be ordered by the Master Builders' Association, and contractors at this time are said to be making estimates on bids for future work on the basis of a dollar-per-hour wage. The contracts of several of the trade unions have expired since the opening of negotiations about wage reductions, and the members are now working without contracts.

This uncertainty of the future working basis is also holding back certain building work which would otherwise proceed, and the resulting effect of the entire situation on the electrical jobbing field here is that business, though steady, continues light. Nothing of particular interest occurred during the past week. Sales were virtually all for small amounts. Stocks of all jobbers and dealers are consistently low, but care is taken to keep them complete. Prices are being fairly well maintained. One pleasing indication of improvement in business conditions is that the railroads terminating in St. Louis are placing large orders for new rolling stock.

**Wire.**—No. 14 rubber-covered moved in about the usual volume last week, but sales of the larger sizes of rubber-covered and of bare and weatherproof were small. In 10,000-ft. lots, No. 14 rubber-covered was priced from $6.50 to $6.70 per 1,000 ft., and the prevailing price in 5,000-ft. lots was $6.75 per 1,000 ft. The base prices on bare and weatherproof remain at 17 cents per pound.

**Engine-Generator Sets.**—Improvement in demand on the part of municipalities and industrial plants in the smaller communities was observed last week, at least two jobs being reported authoritatively. A municipality in the northeastern part of the state voted to expend $175,000 for power-plant enlargements.

**Meters.**—The demand slackened somewhat near the end of the year and has not returned to its former volume. Inquiries are good, however, indicating contemplated distribution extension work on the part of utilities.

**Rigid Conduit.**—The small sizes are selling better, but the larger sizes continue to move slowly. Stocks of most jobbers are in excellent condition. The following prices are made for bundle lots: ½-in. black, $4.73 per 100 ft.; ½-in. galvanized, $5.32; ¾-in. black, $6.20; ¾-in. galvanized, $6.86.

**Lamp Cord.**—Sales were slow at the beginning of the month, but the demand now shows improvement. Stocks are conservatively maintained. No. 18 twisted cord, in 5,000-ft. lots, is selling at the following prices per 1,000 ft.: Cotton, $11.50; silk, $24. No. 18 parallel silk sells for $27 per 1,000 ft. in 5,000-ft. lots.

**Porcelain.**—The demand is steady, with indications of slow improvement. Stocks are in good condition. "Nail-it" knobs are quoted at $19.50 per 1,000 in barrel lots. The 2½-in. tubes are priced at $5.75 per 1,000 and 3-in. tubes at $6.35 per 1,000, both in barrel lots. Two-piece fuseless rosettes sell for $9.90 per 100, one-piece for $6.

## SAN FRANCISCO

A cold spell of unprecedented duration and intensity has doubtless done some harm to the fruit industry of northern and central California, where the rise of sap in trees has been congealed by the frost. In southern California the damage to the citrus crop is estimated as high as $15,000,000. With this exception business conditions for the coming year appear brighter every week and although it cannot definitely be said that normal business is assured, the year promises very much better than was expected a month or so ago. Collections are a little better. The financial condition of the state is shown pretty accurately by the fact that the San Francisco Federal Reserve Bank ranks next to New York and Chicago in clearings.

**Poles.**—Last year was a very poor year in the pole business because nearly all power construction was devoted to power plants and stations and the distributing lines were left to the future. It is expected that a large portion of this lateral line business will develop in 1922. If it does, it can be handled easily, there being no dearth of labor in the Northwest mills nor lack of railroad cars to ship the poles to tidewater. A noticeable feature is the growth of demand for treated poles. A sudden wind flurry on Christmas Day blew down a section of one of the main lines supplying San Francisco. Replacements for this and other breaks probably aggregated ten to fifteen cars.

**Air Heaters.**—Approximately 40,000 electric radiators were sold to jobbers in California during the present season. Dealers' stocks have been considerably lightened by the cold spell referred to above. Approximately 2,500 radiators have been carried over, compared with fully three times that figure for last year. However, the sales last season ran fully a third higher than they did this season. Lower prices, averaging from 20 per cent less on the popular sizes to 10 per cent on larger sizes, caused some stimulation of demand. Dealers are carrying a far better assortment of sizes and styles than formerly.

## SALT LAKE CITY—DENVER

The money market is showing steady improvement from week to week. The two big Intermountain industries that are depending on credit for their rehabilitation are agriculture and live stock. At present it looks as if they will be adequately taken care of by the banks supplemented by liberal federal aid. The wool market is picking up and prospective favorable legislation by Congress is heartening the farmers for the season ahead. Plans are slowly maturing for another building campaign by the real-estate firms in the larger cities. The housing facilities are far from adequate and hundreds of cottages are scheduled for erection as soon as spring weather permits the resumption of construction. Many new apartment houses will also be constructed as investment projects. Electrical contractor-dealers are looking hopefully forward and making preparations for handling some good contracts. Electrical merchandise generally should find a broadened consumer market following the winter months. The labor situation is not encouraging. The building trade unions are solid for the retention of a high wage schedule, while contractors and dealers in building materials believe there must be a readjustment downward. Non-employment prevails to a serious degree.

The price tendency on electrical appliances is decidedly downward. No precipitous jumps are recorded, but little by little the bottom is being sought. Consumer buying meanwhile is scattered and generally unsatisfactory. The government investigation of prices is having the effect of accentuating the buyers' strike. Several smelters that have been idle for months have resumed operation, taking back employees on a wage scale that is 50 per cent reduced.

**Bare Copper Wire.**—Jobbers report a better movement of copper wire and firmer prices. There have been some good deals in both bare copper wire and weatherproof wire during the past week.

**Heating Appliances.**—Only those appliances that have come to be necessities are moving in any volume. Flatirons are selling much better since the reduced price schedule went into effect. One electrical concern has stimulated buying by offering reduced prices on irons and ironing boards.

## SEATTLE—PORTLAND—SPOKANE

Lumbering and shipping, both of which are key industries of the Pacific Northwest coast, continue to show a healthy growth from month to month. The past week witnessed the breaking of the best 1921 records in shipments in the Puget Sound region. Lumber sales during the week were unusually good. Production for the week ended Jan. 14 was 84 per cent of normal, with a total production of 75,500,000 ft. Most mills are again in operation. A much larger percentage of present shipments than formerly is by rail, indicating a strong revival of domestic building throughout the country.

Prices of electrical supplies for the most part seem to have reached a condition of stability. The only important price changes during the week were a 10 per cent reduction on insulators and an advance of 10 cents per 1,000 ft. on No. 14 rubber-covered wire, the last applicable to Portland only.

The announcement by the California-Oregon Power Company that it would immediately begin the construction of a 110,000-volt transmission line from its properties in southern Oregon to the lines of the Mountain States Power Company, 115 miles north, was the most important event in electrical circles during the past week. The completion of this line will provide an outlet for surplus already developed by the company and will make a continuous connection from southern Washington to the Mexican border.

**Porcelain.**—Knobs and tubes being staples in the electrical line, the demand does not fluctuate much from time to time. "Nail-it" knobs are quoted at $26.40 per 1,000 in lots of 500 or more and ⅞-in. tubes at $9.05 in similar lots. Prices are steady.

**Sockets.**—There is little fluctuation from week to week in the demand for sockets. Sales as a rule are in broken lots of from twenty-five to fifty. Prices are steady. Quotations are: Chain-pull sockets, $45 per 100 in standard package quantities; key sockets, $24.75, and keyless, $22.50 in similar quantities. Stocks are ample.

**Line Insulators.**—Orders at present are largely for replacements. New business in considerable volume is in prospect for the spring.

**Cedar Poles.**—Cedar-pole manufacturers in the Spokane region report an increased demand this month for cedar poles in 30-ft. and 40-ft. lengths for telephone and trolley construction in the East and Middle West.

# Manufacturers' Activities

**Devoted to the Business Side of Manufacturing, Distribution and Sales, News from Jobbers and Foreign Fields and a Record of New Devices and Trade Literature**

## Johns-Manville Cancels Wage Cut

Johns-Manville, Inc., electrical jobbers and large producers of asbestos products, have just announced that the 10 per cent wage cut put into effect by the company on Oct. 1, 1921, is to be cancelled and deserving employees are to go back on their former pay scale. Increased efficiency, it is believed, will absorb the difference and in that way will not increase the cost of the company's products. The announcement was made by the board of directors, who met on Jan. 16 at the New York office to plan for 1922.

"This action has been taken," the statement says, "in the belief that the tide of business has turned for the better. Even in the face of lower prices, it is our belief that salary increases at this time will stimulate personnel to harder work and more economical production and distribution and thus bring about a more speedy improvement of business."

## American Fiber Conduit Closes Chicago Office

The American Fiber Conduit Corporation, Fulton, N. Y., has closed its Chicago office and has appointed J. E. O'Neil, formerly manager there, business manager of the company. The manufacturing plant of the company at East Chicago, Indiana, has been closed and dismantled for almost three years while the new plant at Fulton has been manufacturing fiber conduit and fittings of the homogeneous type.

## Bridgeport Brass Company Reorganizes Staff

The staff of the Bridgeport (Conn.) Brass Company has been reorganized according to the company's announcement. Walter R. Clark, formerly manager of the company's Housatonic Avenue plant in Bridgeport, has been appointed general works manager, and the post of general superintendent has been discontinued. Arthur Brewer has been made works manager of the mill-products division, and E. R. Feicht has been placed in charge of the engineering and maintenance department. E. G. Oakley has been appointed works manager for the fabrication department, and Warren D. Blatz has been made general sales manager. The entire process-engineering department has been absorbed by the research engineering department under the supervision of William R. Webster, now vice-president and formerly general superintendent of the company. Paul Swartz will head the cost accounting department for the present.

## Crocker-Wheeler Reports Better December Business

Improvement in business during December and a moderately bright outlook for the coming months is reported by the Crocker-Wheeler Company, through A. L. Doremus, one of the vice-presidents. Business during the fall has been mainly for renewal purposes, Mr. Doremus said, but there have been a number of new plants starting on a small scale, and while orders for this kind of equipment have been individually small, they have been numerous enough to make a good total. The outlook for the coming year, he continued, was complicated by the fact that large users of motors are in many cases overequipped and that industrial building is not expected to increase very greatly; nevertheless, it is the expectation of the company that the influx of small orders will continue, while public buildings, hotels and office buildings will place a much larger share of the total business than in 1921. Later in the year larger orders may be expected as capacity operations are resumed in various plants while others change over to electric drive.

Speaking of general business conditions, Mr. Doremus said that the experience of his company in previous depressions had led to the opinion that the cycle between two peaks of prosperity could be divided into about twelve periods and that industry was now in about the tenth, or rising, period. The silk, food, leather and shoe, wool and cotton, and clothing industries in the order named had been the first to recover in other times of depression, and all of them now have passed the low ebb. In other lines, notably paper, building material, railway equipment, iron and steel, automobile, coal and oil, liquidation, in his opinion, has not been completed.

## Appleton Assumes Control of Anderson Electric

The Appleton Electric Company, 1201 Wellington Avenue, Chicago, has taken over the business of the Anderson Electric & Equipment Company, manufacturer of automobile lighting equipment. The Appleton company will continue the manufacture of this equipment in addition to its regular line of conduit fittings.

## Merger of Automatic Stoker Companies Announced

A consolidation of the Combustion Engineering Corporation of New York, Underfeed Stoker Company of London, Lopulco Systems, Inc., International Pulverized Fuel Company and Combustion Engineering Building, Inc., it is announced has been effected by stock purchase by the International Combustion Engineering Corporation, recently incorporated in Deleware with a 250,000-share capital. One-third of the capital stock of the Société Anonyme des Foyers Automatiques has been acquired. Automatic stokers and accessories are manufactured by a majority of the companies.

Unfilled orders of the companies at the end of the year were in excess of $4,000,000, greater than the entire business for 1921. The combined earnings of the Combustion Engineering Corporation and the Underfeed Stoker Company in 1921 were $669,464 after all charges and taxes had been deducted.

The officers of the new company are: George E. Learnard, president; W. R. Wood, J. Scott Skelly, Joseph V. Santry, Charles J. Peabody, vice-presidents; George H. Hansel, secretary and treasurer, and Benjamin Harrison, assistant secretary. All except the last two named are directors, together with George Foster Peabody, Stephen C. Millett, George W. Wilmot and Stuart H. Patterson.

## Court Ends Heine Boiler Company Litigation

A decree signed in the St. Louis Circuit Court on Jan. 14 ends a long period of litigation over the interests of the Heine Boiler Company, St. Louis, and gives control of the company to C. R. D. Meier, its president. Mr. Meier is understood to have gained control by buying the interests of the other litigants. The history of the court proceedings extends back over sixteen years and in that time became most complicated.

The company was founded in 1884 by Col. E. D. Meier and Theodore Meier. At the time of incorporation a large block of stock was put in the name of Adolphus Meier & Company, a company founded by their father, which at the time was insolvent. The income from this block of stock was intended to pay off the debts of the older company. So successful was the boiler company that that purpose was accomplished in a short time and the block of stock, on account of its earning and voting power, became a bone of contention and the heirs of another brother of the founders of the boiler company brought suit.

C. R. D. Meier, son of Col. E. D. Meier, some time ago conceived the idea of buying out the claims of the other litigants in the suit, and this work has been going on quietly. The company is one of the large boiler manufacturers of the country and for many years was known as the Heine Safety Boiler Company. The word "safety" was dropped from the title only recently.

## Crescent Electric Splits Into Two Companies

The Crescent Electric Company, formerly at 511 Jackson Boulevard, Chicago, has announced a division of its activities and personnel. The division of the company under the name of Crescent Electric Company will now devote all its time to electrical contracting. F. C. Reimers, who was in charge of the old company, will head this company. The new organization, called the Electrical Supplies Company, will operate at the old headquarters, 511 West Jackson Boulevard, and will serve as electrical jobber. A. A. Togesen, who acted as assistant manager of the old Crescent Electric Company, will be in charge of the Electrical Supplies Company.

## Davies Company Incorporated to Manufacture Glassware

The Davies Glass & Manufacturing Company has been incorporated in Ohio to manufacture illuminating glassware, with general offices and works at Martin's Ferry, Ohio. The officers of the company are: T. W. Pursglove, president; E. K. Hoge, vice-president; A. J. Fallen, secretary; W. E. Thomas, treasurer, and William W. Davies, general manager. Arrangements have been made, it is announced, to bring to Martin's Ferry a corps of engineers and specialists with long experience in the design and manufacture of lighting glassware.

## Westinghouse Reorganizes Railway Sales Department

The railway sales department of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has been reorganized, according to announcement by company officials. The department is now organized as follows: F. H. Shepard, director of heavy traction; M. B. Lambert, manager; E. D. Lynch, office manager; F. F. Rohrer, assistant to manager in charge of contracts; C. H. Long, section manager, railway equipment contracts and orders; R. Seybold, manager of price section; T. H. Stoffel, electric railway freight haulage exports; W. R. Stinemetz, manager, and R. W. Carter, assistant manager of the heavy traction division; K. A. Simmon, manager light traction division; J. L. Crouse, manager, and A. W. Lewis, assistant manager railway development and supply division.

## Brush Book Issued by Corliss Company

The Corliss Carbon Company, Bradford, Pa., has issued a booklet treating of the selection and application of carbon brushes and is distributing it to its customers. The publication deals with the physical characteristics of carbon brushes, describes various grades, gives the mechanical details and illustrates various types. A chapter is devoted to determining the selection of suitable grades of brushes for given applications. One of the objects of the book, according to J. F. Kerlin, president of the company, is to enable any electrical engineer or electrician to diagnose any ordinary case of trouble and select the proper grade of brush to use.

## Business of Harder Corporation Taken Over

The Fuels Utilization Corporation, 152 West Forty-second Street, New York, has taken over the sale of licenses to use the patents owned by the Harder Furnace & Engineering Corporation and the services of its engineering department. The Harder Corporation, formerly at 276 Fifth Avenue, has moved to the Forty-second Street address and will occupy offices adjacent to the Fuels Utilization Corporation. The personnel of the engineering department of the former company, it is announced, has been enlarged by the addition to its consulting staff of a number of experienced engineers. The company will continue to furnish designs, estimates and equipment for heating furnaces using fuels other than coal.

## Milwaukee Better Lighting Campaign Under Way

The Milwaukee better-lighting campaign, under the auspices of the Electrical Development Association of Wisconsin, has organized a course in the fundamentals and practices of good lighting for all connected with the industry, the first session having been held Jan. 6. There will be sixteen sessions, covering the basic principles of good lighting, its design and installation and the demonstration of the value and benefits of better lighting in various types of buildings. Arrangements are being made to bring well-known lighting experts to lecture on the various subjects.

Other activities of the association in the campaign have been the use of display advertisements in the Milwaukee daily press, talks by men at the head of the lamp industry and short talks before various business associations of that city.

## 1921 Production Good at Pittsfield Works of General Electric

Production of large transformers and shipments of lightning arresters by the Pittsfield works of the General Electric Company were phenomenal during the past year, according to a report published in the house organ of that division of the company. Total capacity of large transformers shipped exceeded shipments of any previous year, while transformers of 220,000 volts for transmission for 250 miles were completed. Foreign orders for large transformers were large. Distribution transformer output was large but somewhat less than for 1920. Export business in distribution transformers was restricted.

Lightning-arrester shipments for 1921 were the largest in the history of the department. Shipments of motors and miscellaneous electrical devices manufactured at the Pittsfield plant decreased from 1920. The outlook is moderately good, according to the report, for as soon as central stations can obtain capital at lower rates of interest increased purchases of the class of electrical equipment manufactured by the plant may be expected.

**The Roller-Smith Company,** 233 Broadway, New York City, has appointed O. I. Eberhardt as a special sales representative in the counties of Bradford, Wayne, Wyoming, Luzerne and Lackawanna and parts of the counties of Carbon, Monroe and Schuylkill, Pa. He will have his headquarters in the Board of Trade Building, Scranton, Pa. The company manufactures electrical instruments, meters and electric circuit breakers.

**The Tri-State Electric Company** is the new name of the wholesale electrical supply house at 104 Prefontaine Place, Seattle, formerly called the Northwestern Supply Company. The company covers territory in Washington, Oregon and Idaho. A. W. Woodville is president and F. J. Jackson is secretary of the company.

**The Pittsburg Gage & Supply Company,** manufacturer of Gainaday household appliances, has appointed Albert A. Erdman Western sales manager and is preparing to extend its distribution to the Pacific Coast. Until warehouse and office facilities have been arranged Mr. Erdman will make his headquarters at the Clark Hotel, Los Angeles.

**The People's Electrical Supply Company,** 34-36 West Lake Street, Chicago, has started operations as a distributer of electrical supplies and fixtures. H. P. Landerman, formerly connected with the London & Landerman Company, is president of the new firm, and Ira L. Arkin is sales manager.

**The Electro-Magnetic Tool Company,** 2902 Carroll Avenue, Chicago, has doubled its manufacturing facilities by purchasing the plant of G. S. Blakeslee & Company, West 19th Avenue and South 52d Street, Cicero, Ill. This space will be used for the manufacture of electromagnetic equipment.

**S. R. Fralick & Company,** 15 South Clinton Street, Chicago, has become the sole distributer of the Hersh Duplex Signal, formerly the Electric Duplex Signal, a combination bell and buzzer built by the Hersh Electric Specialty Company, 850 Thirty-second Street, Milwaukee.

**Fitts-Morse, Inc.,** manufacturers' agents, 161 Summer Street, Boston, have added to their service the New England representation of the Crescent Brass Products Company, Cleveland, manufacturer of lighting fixtures and fixture parts, and of the Hazard Manufacturing Company, New York City, manufacturer of insulated wires and cables.

## Foreign Trade Notes

ELECTRIFICATION OF CENTRAL RAILWAY OF BRAZIL.—A complete translation of the announcement and call for tenders for the electrification of certain lines of the Central do Brazil Railway and for the supply of traction and transport material and material for construction of substations has been forwarded to the Bureau of Foreign and Domestic Commerce by Consul-General Gaulin of Rio de Janeiro. These specifications will be loaned to firms interested. Inquiries should be sent to the Electrical Equipment Division, Bureau of Foreign and Domestic Commerce, Washington, D. C., referring to file No. 877.

SUPPLIES TO BE PURCHASED BY THE ARGENTINE GOVERNMENT.—The Director-General of Navigation and Ports, Argentine Ministry of Public Works, Buenos Aires, will receive bids until Feb. 28 for material consisting of locomotives, two cranes, cargo towers, concrete mixers, electric motors, etc., for use in connection with port improvements and developments at Buenos Aires. A list of material, together with specifications and forms for submitting bids, has been sent to the Bureau of Foreign and Domestic Commerce. This information may be obtained from the Electrical Division, Bureau of Foreign and Domestic Commerce, Washington, D. C., by referring to miscellaneous exhibit No. 233.

## Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

A mercantile firm in Nova Scotia (No. 621) desires to purchase portable electric lamps having colored pottery bases with shades to match.

An agency on commission is desired by a firm in India (No. 626) for the sale of electrical goods, etc.

A business man in Ontario, Canada (No. 634), who is about to organize an electrical appliance business desires to be placed in communication with manufacturers of electrical apparatus for home, farm and industrial uses.

A retail furniture house in Nova Scotia (No. 658) desires to purchase silk lamp shades and standards.

An electric supply house in Canada (No. 663) desires to purchase glass shades with fringe for electric lamps and boudoir table lamps.

An American commercial agent desires to secure representation in the Orient (No. 668), where he already has an organization of firms dealing in machinery, mechanical supplies, electrical equipment, hardware, etc.

An inquiry has been forwarded by Consul G. K. Stiles, at Patras, Greece, for a Greek firm which desires to represent American manufacturers of electric light plants for residences, stores, hotels, factories, etc. Further information relative to this may be obtained from the Electrical Equipment Division, Bureau of Foreign and Domestic Commerce, Washington, D. C., by referring to exhibit No. 43,595.

## New Apparatus and Publications

WAFFLE RANGE.—The Perfection Electric Products Company, New Washington, Ohio, has developed an electric waffle range with removable waffle breakers, known as the "Excelsior." This range is distributed by George Borgfeldt & Company, Sixteenth Street and Irving Place, New York City.

COOKER.—An electric pressure cooker has been placed on the market by the Albert Sechrist Manufacturing Company, 1717 Logan Street, Denver.

STOVE.—A small electric stove, the "Little Chief," has been placed on the market by the W. B. McAllister Company, 2163-77 East Thirty-first Street, Cleveland.

STOVE AND TOASTER.—The National Stamping & Electric Works, 3212-38 West Lake Street, Chicago, has developed a combination "White Cross" electric stove and toaster.

SMALL CIRCUIT BREAKER.—A device for the protection of fractional horsepower motors, known as the "Minibreaker," has recently been placed on the market by the Miniature Breaker Company, Inc., Fourteenth Street and Governor Place, Long Island City.

SAFETY SWITCHES.—The Columbia Metal Box Company, 226 East 144th Street, New York City, has recently placed on the market a line of Class "B" externally operated inclosed switches.

DOOR OPENER.—The Electrical Products Manufacturing Company, 69 Sprague Street, Providence, R. I. is marketing the "Security" electric door opener.

HEATER.—The Xardell Corporation, Utica, N. Y., has placed on the market a small electric heater the helixes of which are made of a special alloy in which full heat is obtained without operating the resistance at a red heat.

## New Incorporations

THE GRANVILLE ELECTRIC COMPANY has been incorporated under the laws of the State of Delaware with a capital stock of $100,000 to operate light, heat and power plants. The incorporators are Arthur W. Britton, Samuel B. Howard and Robert K. Thistle, 65 Cedar Street, New York City.

THE VULCAN ELECTRIC COMPANY, Akron, Ohio, has been incorporated with a capital of $10,000 by Harry A. Miller and Harry H. Slosower.

THE CUMBERLAND LIGHT COMPANY, Poor Fork, Ky., has been incorporated with a capital stock of $10,000 by J. C. Nash, C. H. Rosnick and R. C. Blair.

THE STOKES ELECTRIC COMPANY, Charleston, S. C., has been chartered with a capital stock of $5,000. The officers are: A. L. Stokes, president, general manager and treasurer, and C. V. Stokes, secretary.

THE POLLACK STOP LIGHT COMPANY, Cleveland, Ohio, has been incorporated with a capital stock of $1,000 by Arthur Krause, Ernest Peiser, A. Barbian, I. S. Burwitz and David M. Loeb.

# Record of Electrical Patents

**Notes on United States Patents**

(Issued Dec. 27, 1921)

1,401,754. TELEPHONE TRANSMITTER; Gaston Boissonnault, Hewlett, N. Y. App. filed July 22, 1921. For listening to speaker without his knowledge.

1,401,874. SAFETY DEVICE; William J. Burke, Youngstown, Ohio. App. filed Dec. 14, 1920. Complete throwing of railroad switch.

1,401,881. PROTECTING DEVICE FOR ELECTRIC CIRCUITS; Nicholad J. Conrad, Chicago, Ill. App. filed March 31, 1917. Simultaneous operation of a number of switching units.

1,401,917. TAPE TRANSMITTER; Donald Murray, London, England. App. filed Aug. 14, 1914. For a multiplex printing telegraph.

(Issued Jan. 3, 1922)

15,258 (reissue). AUTOMATIC STARTER AND CONTROLLER; Ralph D. Ernest, Detroit, Mich. App. filed May 18, 1920. For combustion-engine generating sets.

1,401,947. DYNAMO-ELECTRIC MACHINE; William A. Turbayne, Niagara Falls, N. Y. App. filed March 9, 1916. Combined motor and generator for automobile.

1,401,950. PRINTING TELEGRAPH; Arthur H. Adams, Sparkill, N. Y. App. filed Oct. 29, 1918. Carriage return combined with line and ribbon feed.

1,401,962. MOISTURE-PROOF RECEIVER; John J. Comer, Chicago, Ill. App. filed Dec. 29, 1917. Telephone.

1,401,986. AUTOMOBILE SIGNAL; Joseph Kershaw, Joplin, Mo. App. filed Sept. 25, 1919. Bell arrangement to prevent theft.

1,401,996. DYNAMO-ELECTRIC MACHINE; Robert Lundell, New York, N. Y. App. filed Aug. 30, 1918. Two sets of current inlets and outlets to utilize winding for excitation and compensation.

1,401,998. SYSTEM OF OVERHEAD CONSTRUCTION; Merrill W. Manz, Mansfield, Ohio. App. filed April 23, 1921. Suspending trolley and auxiliary wire from a messenger.

1,401,999. TROLLEY DEVICE; Merrill W. Manz and Samuel S. Matthes, Mansfield, Ohio. App. filed Aug. 19, 1921. Maintaining proper alignment of two trolley conductors.

1,402,000. ELECTRIC CONDUCTOR SUPPORT AND SYSTEM; Samuel S. Matthes, Mansfield, Ohio. App. filed Sept. 2, 1921. Clamp for two trolley wires suspended from messenger.

1,402,021. ELECTRIC WATER HEATER; Walter O. Snelling, Allentown, Pa. App. filed Aug. 24, 1920. Current produced by induction used.

1,402,023. SUSPENSION DEVICE; William C. Starkey, Mansfield, Ohio. App. filed July 28, 1921. Self-clamping, for trolley wire.

1,402,025. FREQUENCY METER; Nikola Tesla, New York, N. Y. App. filed Dec. 18, 1916. Synchronous motor with a speed-responsive device.

1,402,037. TRANSFORMER; James C. Armor, Pittsburgh, Pa. App. filed April 2, 1920. For series lighting circuits.

1,402,048. TIME-LIMIT RELAY; George A. Burnham, Saugus, Mass. App. filed Nov. 22, 1918. Operates upon a definite, inverse or inverse-definite curve.

1,402,070. RESERVE CELL; William Hoppie, Newark, N. J. App. filed Nov. 17, 1919. Primary cell acts only when placed in circuit.

1,402,076. REMOVABLE TROLLEY SHOE; William G. Lamb, Waterloo, Iowa. App. filed May 9, 1921. Combination sliding shoe and rolling contact.

1,402,096. ELECTRICAL APPARATUS FOR INDICATING AND REPEATING MOVEMENTS AT A DISTANCE; Eugene Schneider, Paris, France. App. filed Sept. 13, 1918.

1,402,100. LAMP BOX; Claude de F. Smith, Portland, Ore. App. filed Nov. 30, 1915. For illuminated signs.

1,402,120. CAR, AIR AND ELECTRIC COUPLING; Charles H. Tomlinson, Mansfield, Ohio. App. filed June 16, 1917. Combined in one.

1,402,128. METHOD AND APPARATUS FOR ELECTRICALLY PROMOTING CHEMICAL REACTIONS; Edson R. Wolcott, Los Angeles, Cal. App. filed Oct. 1, 1918. By electric arc.

1,402,202. RINGING ARRANGEMENT FOR MULTIPLEX CIRCUITS; Herman Affel, Brooklyn, N. Y. App. filed Sept. 26, 1919. Employs carrier currents.

1,402,213. SANITARY TRANSMITTER DEVICE FOR TELEPHONES AND DICTAPHONES; A. Connelly, Topeka, Kan. App. filed Nov. 11, 1920. Cover for mouthpiece.

1,402,224. DRY CELL; Harry F. French, Fremont, Ohio. App. filed March 4, 1920. Removable membrane of insulating material between anode and cathode.

1,402,235. OSCILLATION GENERATOR; Harold Jorgenson, Racine, Wis. App. filed Jan. 22, 1920. Combination rotary spark gap and helix.

1,402,240. MEANS FOR NEUTRALIZING THE EFFECT OF EARTH CURRENTS IN A POLAR RELAY; Tom P. Masters, Vancouver B. C., Can. App. filed Sept. 24, 1919. Coil oppositely connected to the working coils of relay.

1,402,245. ELECTRIC FLATIRON; Ernst Muntwyler, Lucerne, Switzerland. App. filed Sept. 13, 1920. Upper and lower parts adapted for ironing by reversing handle.

1,402,246. ELECTRIC HEATING APPARATUS; Ernst Muntwyler, Lucerne, Switzerland. App. filed Sept. 13, 1920. Combined flatiron, chafing dish and foot warmer.

1,402,250. MIXED DRIVING OF VEHICLES; Henri Pieper, Liège, Belgium. App. filed Dec. 22, 1913. Gas-electric drive for vehicles.

1,402,256. TITANIUM COMPLEXES AND METHOD FOR PRODUCING SAME; Henry H. Buckman, Jacksonville, Fla. App. filed Nov. 15, 1920.

1,402,258. MEANS FOR PROTECTING SHIPS FROM COLLISIONS, ETC.; Samuel Shelly, Philadelphia, Pa. App. filed Oct. 18, 1918. Motor-propelled guard placed ahead of ship.

1,402,285. MANUFACTURE OF PRIMARY CELLS; Harold De Olaneta, New Haven, Conn. App. filed Nov. 26, 1919. Manufacture of depolarizing material.

1,402,305. ELECTRORESPONSIVE DEVICE; William W. MacFarlane, Philadelphia, Pa. App. filed Sept. 10, 1917. To produce powerful magnetic field.

1,402,322. ANTI-SIDE-TONE HAND SET; George K. Thompson, Maplewood, N. J. App. filed June 28, 1918. Humming reduced by balancing impedances.

1,402,335. AUTOMATIC ELECTRIC BROODER; William J. Anderson, Caulfield, Victoria, Australia. App. filed April 5, 1920. Automatic heating and ventilating.

1,402,376. HIGH-TEMPERATURE ELECTRIC HEATER; Sebring I. Phelps, Wilmette, Ill. App. filed Feb. 20, 1919. For kitchen range.

1,402,386. SYSTEM OF ELECTRIC CURRENT DISTRIBUTION; Charles A. Turner, Chicago, Ill. App. filed Feb. 16, 1920. Produces small voltage from 110-volt supply.

1,402,396. THERAPEUTIC VAPOR-LAMP APPLIANCE; Fred F. Burdick and Fritz A. Anderson, Milton, Wis. App. filed April 15, 1920. For mounting and safe operation.

1,402,461. CARBURETOR HEATER; Earl G. Watrous, Chicago, Ill. App. filed March 17, 1919. By electric current.

1,402,516. LIGHTING FIXTURE; Carl A. Kopfstein, Cleveland, Ohio. App. filed Nov. 20, 1919. For wall use.

1,402,523. SELF-INDICATING TARGET; Arnold Michoud, Yverdon, Switzerland. App. filed Jan. 28, 1914. Electrically operated.

1,402,546. TELEPHONE RECEIVER; Louis Steinberger, Brooklyn, N. Y. App. filed June 12, 1919. Deadens extraneous sounds that reach diaphragm.

1,402,548. GENERATOR ATTACHMENT MEANS FOR GAS ENGINE; Henry Tiedemann, Newark, N. J. App. filed Oct. 27, 1919. Chain-driven.

1,402,570. ELECTRICAL SWITCH GEAR; William A. Coates, Chorlton-cum-Hardy, England. App. filed Jan. 20, 1921. Interlocking device for switch and circuit breaker.

1,402,585. VAPORIZER; Hirsch Epstein, Jacob J. Mitnick and Joseph M. Bernstein, Chicago, Ill. App. filed March 7, 1921. Electrically heated for automobiles.

1,402,587. ADJUSTABLE RESISTANCE; Sydney Evershed, London, England. App. filed April 22, 1919. Obtains uniform changes.

1,401,591. RECEPTACLE FOR STORAGE BATTERIES; Charles Gallus, Philadelphia, Pa. App. filed Jan. 26, 1921. Made of rubber allowing for expansion of electrolyte.

1,402,599. BATTERY-CELL SEAL; William H. Grimditch, Philadelphia, Pa. App. filed March 4, 1920. Does not require special tools for separation.

1,402,631. PROCESS AND APPARATUS FOR TREATING STORAGE-BATTERY PLATES; Harold M. Martin, New York, N. Y. App. filed April 6, 1920. Heated gas applied to strengthen plates without diminishing capacity.

1,402,656. VOLTAGE REGULATOR; Durl P. Ruger, Chicago, Ill. App. filed April 21, 1920. Arrangement to prevent jerky movements of core.

1,402,673. STORAGE-BATTERY COVER; James M. Skinner and Stockton H. Mortimer, Philadelphia, Pa. App. filed Oct. 6, 1916. Convenient introduction of liquid and escape of gases.

1,402,691. TELEPHONY; Hubert S. Turner, San Diego, Cal. App. filed May 20, 1916. Automatic means of evenly distributing calls among operators.

1,402,714. METHOD OF MANUFACTURING ARTIFICIAL ABRASIVES FROM BAUXITE AND EMERY; Clarence J. Brockbank, Philadelphia, Pa. App. filed Oct. 21, 1920.

1,402,715. VAPORIZER; Harold L. Bumbaugh, Stanford University, Cal. App. filed Nov. 30, 1920. For combustion engines.

(Issued Jan. 10, 1922)

15,261 (reissue). ELECTRIC EXCHANGE SYSTEM; Alexander T. Brown, Syracuse, N. Y. App. filed Aug. 16, 1921. Automatic selective communication.

1,402,750. ELECTRICAL INSULATING AND HEAT-CONDUCTING MATERIAL; Robert W. Earle, Chicago, Ill. App. filed June 27, 1918. For sadirons, soldering irons, stoves, etc.

1,402,751. STORAGE-BATTERY ELECTRODE AND THE PRODUCTION OF SAME; Thomas A. Edison, West Orange, N. J. App. filed Sept. 5, 1919. Nickel-hydroxide film on thin metallic plate.

1,402,756. CONNECTOR FOR TOY ELECTRIC RAILROADS; Albin Frohne, Chicago, Ill. App. filed May 31, 1921. For making connection to rails.

# Construction News

**Projects, Plans, Bids and Contracts Contemplated or Under Way**

## New England States

NEW BEDFORD, MASS. — The street-lighting committee of the City Council has approved recommendations of William P. Briggs, inspector, for improvements to the street-lighting system during the next twelve months. An appropriation of $140,000 will be asked for this work.

NORTH ADAMS, MASS. — The North Adams Gas Light Company has filed petition with the Department of Public Utilities for permission to sell 8,000 shares of stock at $100 a share, the proceeds to be used to pay a floating indebtedness and for certain proposed additions to its plant.

SHELBURNE FALLS, MASS.—The proposal to install a new lighting system in the business section of Shelburne will be submitted to the voters of the towns of Shelburne Falls and Buckland. The plans provide for forty-five lamps, of which thirty will be erected on the Shelburne side and the remainder, or a few more, on the Buckland side of the village.

## Middle Atlantic States

AVON, N. Y.—The Niagara, Lockport & Ontario Power Company, Buffalo, will, it is reported exercise its option to purchase the property of the Livingston-Niagara Power Company, Avon, which furnishes electricity in the villages of Avon, Lima, Livonia, Honeoye Falls, Scottsville and Caledonia.

BINGHAMTON, N. Y.—The Binghamton Light, Heat & Power Company has received permission from the Public Service Commission to construct an electric substation for lighting service in certain parts of Broome County.

BROOKLYN, N. Y.—Bids will be received at the Torpedo Depot, United States Army, Fort Totten, N. Y., until Feb. 10, for furnishing f.o.b. contractor's factory and f.o.b. army supply base, Brooklyn, 16 miles of one-conductor rubber-insulated and armored submarine cable and 16,000 ft. nineteen-conductor rubber-insulated and armored submarine cable. For further information address the officer in charge of torpedo depot. (Circular 22-3.)

BUFFALO, N. Y.—A movement has been started by the Polish American Business Men's Association for improvements to the street-lighting system on Broadway, Fillmore Avenue and Sycamore Street. Walter K. Missall, 964 Sycamore Street, is president of the association.

CATSKILL, N. Y.—The Upper Hudson Electric & Railroad Company has filed notice of an increase in its capital stock from $500,000 to $600,000.

NEW YORK, N. Y.—The New York Edison Company is having plans prepared by William Whitehill, architect, Forty-first Street and Sixth Avenue, for the construction of a two-story and basement power house at 122 East Thirteenth Street.

POUGHKEEPSIE, N. Y. — The Central Hudson Gas & Electric Company has filed notice of an increase in its capital stock from $25,000 to $60,000.

BOGOTA, N. J.—The Bogota Paper & Board Company has awarded a contract to the Austin Co., 217 Broadway, New York, for the erection of a one-story power house and factory addition, to cost about $43,000.

CALDWELL, N. J.—The Borough Council is considering the installation of 50-cp. lamps in certain sections of the municipality, replacing present lamps. Service is furnished by the Public Service Electric Company, Newark.

EGG HARBOR, N. J.—The Ingram Motor Company, Joseph Ingram, 2 Rector Street, New York, president, now building a local plant, will hold in temporary abeyance the erection of a power house at the works, plans for which have been prepared.

IRVINGTON, N. J.—A power department for electric and steam service will be installed in the new hospital to be constructed by the Town Commission to cost about $250,000.

TRENTON, N. J.—An appropriation of $75,000 has been recommended by Governor Edwards for a new power, heating, lighting and cold-storage plant at the Trenton Normal School.

ALLENTOWN, PA. — The Pennsylvania Power & Light Company has made application to the Public Service Commission for permission to take over and merge a number of electric power companies recently organized to operate in Northumberland County.

EASTON, PA.—The Pennsylvania Edison Company, 160 Ferry Street, has completed plans for the erection of a one-story addition to the generator department at its Dock Street plant, 30 ft. x 56 ft., to cost about $55,000. The company will also construct a new mechanical shop and office building, 40 ft. x 65 ft., on Dock Street, to cost approximately $35,000.

HAZLETON, PA.—Under the terms of a new lighting contract the Pennsylvania Power & Light Company will furnish electricity for lamps at every intersection of streets in Hazleton. The plan includes the erection of many new poles, replacing the whole system of rectifiers in the West Diamond substation and the erection of a number of new lines.

PHILADELPHIA, PA.—Bids will be received at the office of William S. Twining, director, Department of City Transit, 1211 Chestnut Street, until Jan. 31, for block signals and interlocking for the Frankford Elevated Railway. (Contract 615.)

PHILADELPHIA, PA.—Plans are under consideration by the Ferris Shoe Company for the construction of a factory and power house at Sixth and Duncannon Streets. Simon & Simon, 249 South Juniper Street, are architects.

PHILADELPHIA, PA. — The John T. Lewis & Brothers Company, Lafayette Building, has commenced excavations for the erection of a two-story power plant, 60 x 70 ft., at its paint factory, Aramingo Street, near Cumberland Street, to cost about $100,000, including equipment.

SHAMOKIN, PA. — The Philadelphia & Reading Coal & Iron Company, Reading Terminal, Philadelphia, is planning to erect an addition to its electric power plant at the Locust Spring colliery, near Shamokin, Pa. New machinery to double the present capacity of the plant will be installed.

BALTIMORE, MD.—The Board of Awards, City Hall, will receive bids until Feb. 1 for furnishing and installing two 2,000,000-gal. motor-driven centrifugal pumps and electrical equipment at the Belair Road pumping plant of the Water Department. William A. Megraw is water engineer.

BALTIMORE, MD.—The Electrical Commission, City Hall Annex No. 1, Charles F. Goob, chief engineer, will receive bids until Feb. 1 for about 100,000 ft. of single vitrified clay conduit for underground electrical service.

BALTIMORE, MD.—The Board of Trustees, Johns Hopkins University, has plans under way for electrical equipment to be installed in the new Pathological and Women's Clinic buildings, to be constructed at a cost of about $725,000. Bids for the electrical apparatus will be asked shortly.

OAKLAND, MD. — The Kendal Lumber Company is planning to rebuild its power house, recently destroyed by fire.

RIVERDALE, MD. — The Citizens' Improvement Association, Dr. J. S. Caldwell, president, is considering tentative plans for the erection of a municipal electric power plant. It is proposed to purchase electricity to be distributed by the municipal station.

CHARLESTON, W. VA. — The Raleigh-Wyoming Coal Company, Professional Building, will build a new power plant at its properties near Glen Rogers, W. Va. Electrical machinery will also be installed for mining service.

CHARLESTON, W. VA. — An electric plant will be installed in the new ice-manufacturing plant to be constructed by the Diamond Ice & Coal Company, 912 Bullit Street, 100 ft. x 100 ft., to cost about $300,000, including equipment. A. C. Bishop, 427 Guardian Building, Cleveland, Ohio, is engineer.

CHARLESTON, W. VA. — The United Light & Power Company, recently organized, is planning to construct a transmission line in the vicinity of Iaeger, W. Va. H. P. Musser and C. H. Elston head the company.

SOUTH CHARLESTON, W. VA. — The City Council is considering issuing $300,000 in bonds for improvements to the street-lighting system and streets and the installation of a waterworks plant.

## North Central States

FOWLERVILLE, MICH. — The Detroit Edison Company, Detroit, has acquired the local municipal lighting plant and equipment and in the future will furnish service here. A ten-year franchise has been granted.

IRON MOUNTAIN, MICH. — The Ford Motor Company will commence the immediate installation of an additional turbo-generator at its local power plant. The company has commenced the construction of a dam at Flat Rock, near Brooklyn, Mich., across the Huron River, preliminary to the construction of a hydro-electric plant here.

JACKSON, MICH. — The T. S. Rogers Company has work under way on a new two-story power house at its plant, 25 ft. x 35 ft.

MICHIGAN CITY, IND.—Subject to the approval of the Public Service Commission, the Northern Indiana Gas & Electric Company has completed arrangements with the Chicago, Lake Shore & South Bend Railway Company, for the leasing of the latter's generating plant at Michigan City for a period of twenty years. The electric company heretofore has purchased energy from the railway company, and in the future the first noted will furnish service to the railway.

COLUMBUS, OHIO.—The City Council has adopted a resolution authorizing the installation of two-lamp inverted globe standards on West Broad Street from the bridge to Central Avenue.

FINDLAY, OHIO.—A power house will be built by the Glenwood Motor Car Company, East Seventy-first Street and Euclid Avenue, Cleveland, in connection with its proposed new local plant.

HAMILTON, OHIO. — The City Council has awarded contract to the Froehlich & Emery Engineering Company, Second National Bank Building, Toledo, to prepare plans for the proposed municipal electric light plant at Hamilton. The cost of the plant is estimated at $650,000.

MEDWAY, OHIO.—The Indiana, Columbus & Eastern Traction Company, Cincinnati, it is reported, has applied to the federal court at Telodo for permission to shut down its Medway power plant and purchase electricity from the Dayton Power & Light Company. The plans provide for the installation of entirely new equipment in each of the eighteen substations to allow for change in its system from 25 cycles to 60 cycles.

LOUISVILLE, KY.—Arrangements have been made by the public service and publicity committee of the Louisville Real Estate Board for a conference with the Louisville Gas & Electric Company to discuss the cost of a suggested ornamental lighting system on a portion of Broadway.

HAMMOND, IND.—Bids, it is reported, will be received early in the spring by the Board of Works for the construction of an electrically operated pumping plant, to cost, with machinery, about $90,000. W. F. Bridge, Rimbach Block, is engineer. A. G. Kinert is clerk.

INDIANAPOLIS, IND. — The Indiana Electric Corporation has filed a petition with the Public Service Commission for permission to construct a power plant in the coal fields on the Wabash River. The company has also requested to consolidate seven Indiana public utility companies.

INDIANAPOLIS, IND.—The Terre Haute, Indianapolis and Eastern Traction Company has two propositions under consideration, the first for additions to the West Tenth Street power station and the other for the construction of a new power plant in Vigo County or in an adjacent coal field. The cost of the project is estimated at $3,000,000. Nothing definite has been decided upon. Robert I. Todd is president.

INDIANAPOLIS, IND. — The Indiana Hydro-Electric Power Company, recently organized, has disposed of a bond issue of $1,250,000, the proceeds to be used in part for the erection of a new hydro-electric generating plant at Norway on the Tippecanoe River, to be followed by the erection of three other similar plants in this same section, near Monticello, with total plant capacity of about 29,000 hp. The entire output of the company will be purchased by the Middle West Utilities Company, with which the Indiana company is closely connected. Samuel Insull is president of the new company.

SEYMOUR, IND.—The Interstate Public Service Company, Indianapolis, has started work on the erection of a high-tension transmission line from Reddington to North Vernon. When completed it will be connected with the line extending from Louisville to Indianapolis. Electrical energy will be purchased by the North Vernon Electric Light Company. The Interstate company is also erecting a transmission line from Mineral Springs to Elizabethtown, in Bartholomew County, to supply electricity to farms and residents along the line.

LENA, ILL.—The United Utilities Co. will soon begin active work on the construction of its new hydro-electric power plant on the Pecatonnica River, Martintown, Wis. The station will cost about $85,000. Holland, Ackerman & Holland, 100 East Liberty Avenue, Ann Arbor, Mich., are engineers. E. F. Benifer, Lena, is president.

SPRINGFIELD, ILL.—The Illinois Power Company, recently organized, has been authorized by the Illinois Commerce Commission to take over the properties of the Springfield Gas & Electric Company and the Springfield Consolidated Railway Company and also the DeKalb and Sycamore Electric Company operating in DeKalb and Sycamore. The new company, in addition to financing its share of the downtown improvement plan, which includes placing wires underground, etc., will have sufficient funds for additions to its power plant at Tenth Street and Capitol Avenue and for the removal of the gas plant from First and Washington Streets to the northern part of the city. The amount to be spent on immediate improvements will be approximately $3,000,000. A. D. Mackie is general manager of the new company.

MILWAUKEE, WIS. — The Board of Education, Tenth and Prairie Streets, will build an addition to the power house at the school on Center Street.

VERONA, WIS.—The Dane County Board, care of M. Sommers, 512 West Wilson Street, Madison, is having plans prepared for the construction of a one-story power house, 45 ft. x 50 ft., in Verona, to cost about $150,000. A. D. Conover, Tenney Block, Madison, is architect.

BOONE, IA.—Plans are being prepared for the erection of a municipal hydro-electric plant on the Des Moines River. Burns & McDonnell, 402 Interstate Building, Kansas City, Mo., are engineers.

DEVILS LAKE, N. D.—Savage & White, 913 Pioneer Building, St. Paul, Minn., are taking bids for the erection of a one-story addition to their local power house, 40 ft. x 60 ft. A. H. Savage is head.

ABERDEEN, S. D.—The Aberdeen Light & Power Company is contemplating the installation of an additional generating unit at its plant. R. E. Crockett is superintendent.

COWLES, NEB.—The City Council has plans under way for the installation of a complete electric lighting system. Grant, Fulton & Letton, 505 Bankers' Life Building, Lincoln, Neb., are consulting engineers.

## Southern States

DURHAM, N. C.—The construction of an electric lighting system in Durham is under consideration. R. W. Rigsby is city manager.

WILSON, N. C.—Bonds to the amount of $30,000 have been authorized for extensions to the municipal electric light system.

MEIGS, GA.—The City Council has approved plans for remodeling and improving the municipal electric lighting plant and for the construction of a new transmission line, the latter to cost about $10,000. R. E. Davis is Mayor.

CRESCENT CITY, FLA.—The construction of an addition to the municipal electric power plant is under consideration. A. B. Harbison is chairman of the board of trustees.

ORLANDO, FLA.—The City Council has preliminary plans in progress for the installation of new equipment at the municipal lighting plant.

PERRY, FLA.—The City Council is considering the installation of an electric light system in Perry, to cost about $3,000. S. P. Clowell is clerk.

WAVERLY, TENN. — The Hurricane Light & Power Company, recently incorporated with a capital stock of $1,000,000 by Roy Carter and others, contemplates the construction of a dam and power plant across Hurricane Creek. The present plans provide for a plant with an initial output of 1,500 hp. and an ultimate capacity of from 5,000 hp. to 6,000 hp., and also for creating a lake to cover from 2,000 to 3,000 acres. Electricity will be furnished to towns from Dickson to Hollow Rock. E. T. Stanfield, Little Rock, Ark., is engineer.

LAMBERT, MISS.—The Common Council will soon make improvements in the municipal electric lighting system. A bond issue has been sold.

SHREVEPORT, LA.—The Southwestern Gas & Electric Company is considering the installation of an additional generating unit consisting of a 3,500-kw. generator. The cost is estimated at $150,000.

ORANGE, TEX.—The Orange Water, Ice & Light Company contemplates the installation of additional equipment to double the output of its electric power plant.

PARIS, TEX.—The City Council is considering plans for the installation of a complete waterworks plant and system, including an electrically operated pumping plant, etc., to cost about $1,000,000. John B. Hawley, Cotton Exchange Building, Fort Worth, is consulting engineer.

VERNON, TEX.—Bonds to the amount of $100,000 have been voted for the construction of a municipal electric light plant.

WELLINGTON, TEX.—Plans are under way by the Council for the construction of a municipal electric light and power plant, for which bonds to the amount of $50,000 have been approved.

## Pacific and Mountain States

LEAVENWORTH, WASH. — The City Council is considering the construction of an electric light and power system in Leavenworth.

SAN DIEGO, CAL.—The San Diego Consolidated Gas & Electric Company contemplates improvements to its system, including increasing the output of its electric generating plant from 24,000 hp. to 44,000 hp. and extensions to its gas mains and pole lines throughout the city and county. The sum of $1,500,000 has been appropriated for improvements and extensions during 1922. H. H. Jones is president and general manager.

TURLOCK, CAL.—An appropriation of $110,000 has been made by the Pacific Gas & Electric Company, it is understood, for extensive reconstruction work in connection with the Turlock electric system. The plans provide for the erection of a new 60,000-volt transmission line from Modesto to Hughson, to cost about $40,000; new substation at Hughson, $30,000, and rebuilding the Turlock substation at a cost of $15,000. Charles S. Northcutt is division manager.

PRICE, UTAH.—The City Council is considering, among other improvements for the coming year, extensions to the municipal electric plant and improvements to the street-lighting system on Main Street.

RICHFIELD, UTAH.—The establishment of a municipal power plant is reported to be under consideration by the city officials.

SALT LAKE CITY, UTAH.—George W. Davy of Salt Lake City has filed application with the State Engineer for the use of 25 sec.-ft. of water from Otter Creek or Daniels Creek in Sevier County for power purposes. The present plans provide for developing 1,400 hp. under a head of 724 ft. for use in Sevier, Emery and Wayne Counties.

BOISE, IDAHO.—The board of directors of the Idaho Power Company has authorized an expenditure of $200,000 for construction on projects under way, including the Mountain Home-Featherville transmission line and the rebuilding of the Seventeenth Street substation in Boise.

## Canada

COURTRIGHT, ONT.—Surveys are being made for the installation of an electric light and power system in Courtright. The cost is estimated at about $35,000. J. N. Wilson, 190 University Avenue, Toronto, is engineer.

WOODSTOCK, ONT. — The Electrical Commission is contemplating extensions to the electric transmission line and the installation of new transformers. Prices are wanted on materials and equipment. The cost is estimated at $28,000. J. G. Archibald, Woodstock, is engineer.